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XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0152-1000-0500-1000
Design Head (m)	0.500
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	152
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	10.0
Flush-Flo™	0.225	10.0
Kick-Flo®	0.396	9.0
Mean Flow over Head Range	-	7.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.5	1.200	15.1	3.000	23.4	7.000	35.3
0.200	10.0	1.400	16.3	3.500	25.2	7.500	36.5
0.300	9.8	1.600	17.3	4.000	26.9	8.000	37.7
0.400	9.0	1.800	18.3	4.500	28.5	8.500	38.9
0.500	10.0	2.000	19.3	5.000	30.0	9.000	40.1
0.600	10.9	2.200	20.2	5.500	31.2	9.500	41.2
0.800	12.5	2.400	21.1	6.000	32.6		
1.000	13.9	2.600	21.9	6.500	34.0		

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XP Solutions			Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
	15 min Summer	0.068	0.068	3.0	853.9	O K
	30 min Summer	0.088	0.088	4.8	1098.9	O K
	60 min Summer	0.106	0.106	6.5	1337.8	O K
	120 min Summer	0.130	0.130	8.8	1632.4	O K
	180 min Summer	0.143	0.143	10.1	1803.9	O K
	240 min Summer	0.152	0.152	10.8	1914.7	O K
	360 min Summer	0.162	0.162	11.5	2039.9	O K
	480 min Summer	0.167	0.167	11.9	2099.4	O K
	600 min Summer	0.169	0.169	12.0	2126.8	O K
	720 min Summer	0.170	0.170	12.0	2136.3	O K
	960 min Summer	0.169	0.169	12.0	2123.9	O K
	1440 min Summer	0.164	0.164	11.7	2065.2	O K
	2160 min Summer	0.159	0.159	11.3	2006.5	O K
	2880 min Summer	0.156	0.156	11.1	1968.9	O K
	4320 min Summer	0.153	0.153	10.9	1927.7	O K
	5760 min Summer	0.151	0.151	10.7	1902.5	O K
	7200 min Summer	0.150	0.150	10.6	1885.5	O K
	8640 min Summer	0.149	0.149	10.5	1875.1	O K
	10080 min Summer	0.149	0.149	10.5	1869.8	O K
	15 min Winter	0.076	0.076	3.7	956.2	O K
	30 min Winter	0.098	0.098	5.7	1230.4	O K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
	15 min Summer	152.119	0.0	203.6	23	
	30 min Summer	98.091	0.0	305.8	38	
	60 min Summer	59.966	0.0	650.9	68	
	120 min Summer	36.932	0.0	863.6	128	
	180 min Summer	27.466	0.0	993.2	186	
	240 min Summer	22.073	0.0	1080.0	246	
	360 min Summer	15.975	0.0	1183.9	366	
	480 min Summer	12.562	0.0	1239.5	484	
	600 min Summer	10.371	0.0	1270.9	604	
	720 min Summer	8.843	0.0	1288.3	722	
	960 min Summer	6.842	0.0	1297.4	962	
	1440 min Summer	4.743	0.0	1266.5	1244	
	2160 min Summer	3.288	0.0	1920.9	1600	
	2880 min Summer	2.547	0.0	1931.8	1992	
	4320 min Summer	1.811	0.0	1904.8	2812	
	5760 min Summer	1.443	0.0	2662.6	3632	
	7200 min Summer	1.224	0.0	2783.6	4400	
	8640 min Summer	1.080	0.0	2887.6	5192	
	10080 min Summer	0.980	0.0	2962.0	5960	
	15 min Winter	152.119	0.0	245.1	23	
	30 min Winter	98.091	0.0	364.9	38	
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<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
60 min Winter	0.119	0.119	7.8	1497.6	O K	
120 min Winter	0.145	0.145	10.2	1827.7	O K	
180 min Winter	0.160	0.160	11.4	2020.3	O K	
240 min Winter	0.170	0.170	12.0	2145.1	O K	
360 min Winter	0.182	0.182	12.1	2288.9	O K	
480 min Winter	0.187	0.187	12.1	2360.1	O K	
600 min Winter	0.190	0.190	12.1	2395.5	O K	
720 min Winter	0.191	0.191	12.1	2410.7	O K	
960 min Winter	0.191	0.191	12.1	2406.0	O K	
1440 min Winter	0.186	0.186	12.1	2343.3	O K	
2160 min Winter	0.178	0.178	12.0	2243.9	O K	
2880 min Winter	0.173	0.173	12.0	2178.7	O K	
4320 min Winter	0.166	0.166	11.8	2087.8	O K	
5760 min Winter	0.160	0.160	11.4	2020.9	O K	
7200 min Winter	0.156	0.156	11.1	1968.6	O K	
8640 min Winter	0.153	0.153	10.9	1928.3	O K	
10080 min Winter	0.151	0.151	10.7	1896.8	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
60 min Winter	59.966	0.0	763.0	66		
120 min Winter	36.932	0.0	1004.7	126		
180 min Winter	27.466	0.0	1149.9	184		
240 min Winter	22.073	0.0	1246.2	242		
360 min Winter	15.975	0.0	1357.8	360		
480 min Winter	12.562	0.0	1414.6	476		
600 min Winter	10.371	0.0	1445.0	592		
720 min Winter	8.843	0.0	1460.5	706		
960 min Winter	6.842	0.0	1464.6	934		
1440 min Winter	4.743	0.0	1422.1	1362		
2160 min Winter	3.288	0.0	2187.5	1688		
2880 min Winter	2.547	0.0	2202.7	2136		
4320 min Winter	1.811	0.0	2172.6	3028		
5760 min Winter	1.443	0.0	3019.3	3872		
7200 min Winter	1.224	0.0	3158.3	4688		
8640 min Winter	1.080	0.0	3278.5	5536		
10080 min Winter	0.980	0.0	3365.6	6352		
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.000

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 1.500	4	8 1.500

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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0166-1230-0500-1230 Design Head (m) 0.500 Design Flow (l/s) 12.3 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 166 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>12.3</td></tr><tr><td>Flush-Flo™</td><td>0.242</td><td>12.3</td></tr><tr><td>Kick-Flo®</td><td>0.406</td><td>11.1</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>9.6</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>5.9</td><td>1.200</td><td>18.6</td><td>3.000</td><td>28.9</td><td>7.000</td><td>43.5</td></tr><tr><td>0.200</td><td>12.2</td><td>1.400</td><td>20.0</td><td>3.500</td><td>31.1</td><td>7.500</td><td>45.0</td></tr><tr><td>0.300</td><td>12.2</td><td>1.600</td><td>21.4</td><td>4.000</td><td>33.2</td><td>8.000</td><td>46.5</td></tr><tr><td>0.400</td><td>11.2</td><td>1.800</td><td>22.6</td><td>4.500</td><td>35.1</td><td>8.500</td><td>48.0</td></tr><tr><td>0.500</td><td>12.3</td><td>2.000</td><td>23.8</td><td>5.000</td><td>37.0</td><td>9.000</td><td>49.4</td></tr><tr><td>0.600</td><td>13.4</td><td>2.200</td><td>24.9</td><td>5.500</td><td>38.5</td><td>9.500</td><td>50.7</td></tr><tr><td>0.800</td><td>15.4</td><td>2.400</td><td>25.9</td><td>6.000</td><td>40.2</td><td></td><td></td></tr><tr><td>1.000</td><td>17.1</td><td>2.600</td><td>27.0</td><td>6.500</td><td>41.9</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	12.3	Flush-Flo™	0.242	12.3	Kick-Flo®	0.406	11.1	Mean Flow over Head Range	-	9.6	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	5.9	1.200	18.6	3.000	28.9	7.000	43.5	0.200	12.2	1.400	20.0	3.500	31.1	7.500	45.0	0.300	12.2	1.600	21.4	4.000	33.2	8.000	46.5	0.400	11.2	1.800	22.6	4.500	35.1	8.500	48.0	0.500	12.3	2.000	23.8	5.000	37.0	9.000	49.4	0.600	13.4	2.200	24.9	5.500	38.5	9.500	50.7	0.800	15.4	2.400	25.9	6.000	40.2			1.000	17.1	2.600	27.0	6.500	41.9		
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)																																																																																																
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0.100	5.9	1.200	18.6	3.000	28.9	7.000	43.5																																																																																														
0.200	12.2	1.400	20.0	3.500	31.1	7.500	45.0																																																																																														
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0.500	12.3	2.000	23.8	5.000	37.0	9.000	49.4																																																																																														
0.600	13.4	2.200	24.9	5.500	38.5	9.500	50.7																																																																																														
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.140	0.140	13.3	1760.5	O K
30 min Summer	0.179	0.179	19.4	2261.1	O K
60 min Summer	0.217	0.217	24.0	2743.3	O K
120 min Summer	0.264	0.264	24.6	3338.4	O K
180 min Summer	0.291	0.291	24.8	3684.4	O K
240 min Summer	0.308	0.308	24.8	3907.2	O K
360 min Summer	0.327	0.327	24.8	4155.7	O K
480 min Summer	0.336	0.336	24.8	4269.0	O K
600 min Summer	0.340	0.340	24.8	4315.6	O K
720 min Summer	0.340	0.340	24.8	4324.1	O K
960 min Summer	0.336	0.336	24.8	4273.8	O K
1440 min Summer	0.323	0.323	24.8	4099.0	O K
2160 min Summer	0.308	0.308	24.8	3908.0	O K
2880 min Summer	0.297	0.297	24.8	3765.7	O K
4320 min Summer	0.281	0.281	24.7	3565.5	O K
5760 min Summer	0.269	0.269	24.7	3410.9	O K
7200 min Summer	0.260	0.260	24.6	3288.7	O K
8640 min Summer	0.252	0.252	24.5	3191.1	O K
10080 min Summer	0.246	0.246	24.5	3115.4	O K
15 min Winter	0.157	0.157	16.0	1971.1	O K
30 min Winter	0.201	0.201	22.4	2532.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	733.9	23	
30 min Summer	98.091	0.0	1049.2	38	
60 min Summer	59.966	0.0	1896.6	68	
120 min Summer	36.932	0.0	2415.3	126	
180 min Summer	27.466	0.0	2713.6	186	
240 min Summer	22.073	0.0	2905.9	246	
360 min Summer	15.975	0.0	3126.7	366	
480 min Summer	12.562	0.0	3238.3	484	
600 min Summer	10.371	0.0	3297.2	604	
720 min Summer	8.843	0.0	3325.9	722	
960 min Summer	6.842	0.0	3328.8	962	
1440 min Summer	4.743	0.0	3225.1	1228	
2160 min Summer	3.288	0.0	4651.6	1564	
2880 min Summer	2.547	0.0	4727.8	1964	
4320 min Summer	1.811	0.0	4795.7	2768	
5760 min Summer	1.443	0.0	6005.1	3568	
7200 min Summer	1.224	0.0	6320.6	4328	
8640 min Summer	1.080	0.0	6615.0	5104	
10080 min Summer	0.980	0.0	6863.3	5856	
15 min Winter	152.119	0.0	864.3	23	
30 min Winter	98.091	0.0	1222.3	37	
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XP Solutions			Source Control 2019.1		
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.243	0.243	24.4	3075.2	O K
120 min Winter	0.296	0.296	24.8	3747.6	O K
180 min Winter	0.326	0.326	24.8	4140.0	O K
240 min Winter	0.346	0.346	24.8	4394.3	O K
360 min Winter	0.368	0.368	24.8	4682.4	O K
480 min Winter	0.379	0.379	24.8	4818.9	O K
600 min Winter	0.383	0.383	24.8	4881.0	O K
720 min Winter	0.385	0.385	24.8	4901.1	O K
960 min Winter	0.382	0.382	24.8	4867.3	O K
1440 min Winter	0.368	0.368	24.8	4686.0	O K
2160 min Winter	0.346	0.346	24.8	4395.1	O K
2880 min Winter	0.329	0.329	24.8	4181.4	O K
4320 min Winter	0.303	0.303	24.8	3841.7	O K
5760 min Winter	0.281	0.281	24.7	3565.4	O K
7200 min Winter	0.264	0.264	24.6	3339.4	O K
8640 min Winter	0.249	0.249	24.5	3155.9	O K
10080 min Winter	0.238	0.238	24.4	3009.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2173.0	66	
120 min Winter	36.932	0.0	2735.6	124	
180 min Winter	27.466	0.0	3051.1	184	
240 min Winter	22.073	0.0	3248.3	242	
360 min Winter	15.975	0.0	3463.1	360	
480 min Winter	12.562	0.0	3560.4	476	
600 min Winter	10.371	0.0	3602.2	592	
720 min Winter	8.843	0.0	3612.7	708	
960 min Winter	6.842	0.0	3579.0	934	
1440 min Winter	4.743	0.0	3400.7	1370	
2160 min Winter	3.288	0.0	5219.1	1692	
2880 min Winter	2.547	0.0	5297.2	2136	
4320 min Winter	1.811	0.0	5347.0	3024	
5760 min Winter	1.443	0.0	6760.7	3856	
7200 min Winter	1.224	0.0	7121.7	4616	
8640 min Winter	1.080	0.0	7461.1	5440	
10080 min Winter	0.980	0.0	7752.4	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.200

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	3.100	4 8	3.100

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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0224-2480-0500-2480 Design Head (m) 0.500 Design Flow (l/s) 24.8 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 224 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 300 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>24.8</td></tr><tr><td>Flush-Flo™</td><td>0.305</td><td>24.8</td></tr><tr><td>Kick-Flo®</td><td>0.441</td><td>23.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>18.1</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.5</td><td>1.200</td><td>37.7</td><td>3.000</td><td>58.7</td><td>7.000</td><td>88.4</td></tr><tr><td>0.200</td><td>22.3</td><td>1.400</td><td>40.6</td><td>3.500</td><td>63.3</td><td>7.500</td><td>91.5</td></tr><tr><td>0.300</td><td>24.8</td><td>1.600</td><td>43.3</td><td>4.000</td><td>67.5</td><td>8.000</td><td>94.6</td></tr><tr><td>0.400</td><td>24.1</td><td>1.800</td><td>45.9</td><td>4.500</td><td>71.5</td><td>8.500</td><td>97.5</td></tr><tr><td>0.500</td><td>24.8</td><td>2.000</td><td>48.3</td><td>5.000</td><td>75.3</td><td>9.000</td><td>100.4</td></tr><tr><td>0.600</td><td>27.0</td><td>2.200</td><td>50.5</td><td>5.500</td><td>78.2</td><td>9.500</td><td>103.2</td></tr><tr><td>0.800</td><td>31.0</td><td>2.400</td><td>52.7</td><td>6.000</td><td>81.7</td><td></td><td></td></tr><tr><td>1.000</td><td>34.5</td><td>2.600</td><td>54.8</td><td>6.500</td><td>85.1</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3		Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	24.8	Flush-Flo™	0.305	24.8	Kick-Flo®	0.441	23.4	Mean Flow over Head Range	-	18.1	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	7.5	1.200	37.7	3.000	58.7	7.000	88.4	0.200	22.3	1.400	40.6	3.500	63.3	7.500	91.5	0.300	24.8	1.600	43.3	4.000	67.5	8.000	94.6	0.400	24.1	1.800	45.9	4.500	71.5	8.500	97.5	0.500	24.8	2.000	48.3	5.000	75.3	9.000	100.4	0.600	27.0	2.200	50.5	5.500	78.2	9.500	103.2	0.800	31.0	2.400	52.7	6.000	81.7			1.000	34.5	2.600	54.8	6.500	85.1		
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)																																																																																																
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.135	0.135	12.6	1703.9	O K
30 min Summer	0.174	0.174	18.6	2188.6	O K
60 min Summer	0.210	0.210	23.4	2655.2	O K
120 min Summer	0.255	0.255	24.4	3229.7	O K
180 min Summer	0.281	0.281	24.5	3563.6	O K
240 min Summer	0.298	0.298	24.6	3778.1	O K
360 min Summer	0.317	0.317	24.6	4016.7	O K
480 min Summer	0.325	0.325	24.6	4124.5	O K
600 min Summer	0.328	0.328	24.6	4167.5	O K
720 min Summer	0.329	0.329	24.6	4173.9	O K
960 min Summer	0.325	0.325	24.6	4121.5	O K
1440 min Summer	0.312	0.312	24.6	3953.4	O K
2160 min Summer	0.298	0.298	24.6	3772.0	O K
2880 min Summer	0.287	0.287	24.6	3635.4	O K
4320 min Summer	0.272	0.272	24.5	3442.5	O K
5760 min Summer	0.260	0.260	24.4	3293.8	O K
7200 min Summer	0.251	0.251	24.3	3177.5	O K
8640 min Summer	0.244	0.244	24.3	3084.0	O K
10080 min Summer	0.238	0.238	24.2	3012.2	O K
15 min Winter	0.152	0.152	15.2	1907.8	O K
30 min Winter	0.194	0.194	21.4	2450.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	698.3	23	
30 min Summer	98.091	0.0	1001.1	38	
60 min Summer	59.966	0.0	1819.4	68	
120 min Summer	36.932	0.0	2323.9	126	
180 min Summer	27.466	0.0	2615.2	186	
240 min Summer	22.073	0.0	2804.0	246	
360 min Summer	15.975	0.0	3022.5	364	
480 min Summer	12.562	0.0	3134.7	484	
600 min Summer	10.371	0.0	3195.4	604	
720 min Summer	8.843	0.0	3226.7	722	
960 min Summer	6.842	0.0	3235.9	960	
1440 min Summer	4.743	0.0	3147.8	1214	
2160 min Summer	3.288	0.0	4493.0	1560	
2880 min Summer	2.547	0.0	4568.0	1960	
4320 min Summer	1.811	0.0	4636.8	2764	
5760 min Summer	1.443	0.0	5801.1	3568	
7200 min Summer	1.224	0.0	6104.8	4328	
8640 min Summer	1.080	0.0	6387.9	5104	
10080 min Summer	0.980	0.0	6626.0	5848	
15 min Winter	152.119	0.0	823.4	23	
30 min Winter	98.091	0.0	1168.1	37	
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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.235	0.235	24.1	2975.8	O K
120 min Winter	0.286	0.286	24.6	3625.5	O K
180 min Winter	0.316	0.316	24.6	4004.3	O K
240 min Winter	0.335	0.335	24.6	4249.4	O K
360 min Winter	0.356	0.356	24.6	4526.1	O K
480 min Winter	0.366	0.366	24.6	4656.2	O K
600 min Winter	0.371	0.371	24.6	4714.4	O K
720 min Winter	0.372	0.372	24.6	4731.8	O K
960 min Winter	0.369	0.369	24.6	4695.5	O K
1440 min Winter	0.355	0.355	24.6	4514.2	O K
2160 min Winter	0.334	0.334	24.6	4237.5	O K
2880 min Winter	0.318	0.318	24.6	4030.1	O K
4320 min Winter	0.292	0.292	24.6	3701.5	O K
5760 min Winter	0.271	0.271	24.5	3435.2	O K
7200 min Winter	0.254	0.254	24.4	3219.2	O K
8640 min Winter	0.241	0.241	24.2	3044.6	O K
10080 min Winter	0.230	0.230	24.1	2906.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2088.0	66	
120 min Winter	36.932	0.0	2636.6	124	
180 min Winter	27.466	0.0	2946.5	184	
240 min Winter	22.073	0.0	3142.2	242	
360 min Winter	15.975	0.0	3358.7	360	
480 min Winter	12.562	0.0	3460.7	476	
600 min Winter	10.371	0.0	3508.1	592	
720 min Winter	8.843	0.0	3524.5	706	
960 min Winter	6.842	0.0	3502.9	934	
1440 min Winter	4.743	0.0	3348.7	1360	
2160 min Winter	3.288	0.0	5046.5	1684	
2880 min Winter	2.547	0.0	5124.7	2132	
4320 min Winter	1.811	0.0	5183.2	2988	
5760 min Winter	1.443	0.0	6533.0	3808	
7200 min Winter	1.224	0.0	6880.6	4616	
8640 min Winter	1.080	0.0	7207.0	5368	
10080 min Winter	0.980	0.0	7486.1	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.000

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	3.000	4 8	3.000

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		Micro Drainage																																																																																																			
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Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)																																																																																																
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.041	0.041	1.0	512.8	O K
30 min Summer	0.053	0.053	1.6	660.6	O K
60 min Summer	0.064	0.064	2.3	805.6	O K
120 min Summer	0.079	0.079	3.3	986.6	O K
180 min Summer	0.087	0.087	3.9	1093.9	O K
240 min Summer	0.093	0.093	4.2	1164.9	O K
360 min Summer	0.099	0.099	4.7	1249.0	O K
480 min Summer	0.103	0.103	4.9	1293.2	O K
600 min Summer	0.105	0.105	5.1	1318.0	O K
720 min Summer	0.106	0.106	5.2	1331.8	O K
960 min Summer	0.107	0.107	5.2	1340.2	O K
1440 min Summer	0.106	0.106	5.1	1326.9	O K
2160 min Summer	0.103	0.103	4.9	1292.8	O K
2880 min Summer	0.102	0.102	4.9	1275.0	O K
4320 min Summer	0.101	0.101	4.8	1267.6	O K
5760 min Summer	0.101	0.101	4.8	1270.4	O K
7200 min Summer	0.102	0.102	4.9	1278.0	O K
8640 min Summer	0.103	0.103	4.9	1287.7	O K
10080 min Summer	0.103	0.103	5.0	1299.8	O K
15 min Winter	0.046	0.046	1.2	574.3	O K
30 min Winter	0.059	0.059	2.0	739.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	75.2	23	
30 min Summer	98.091	0.0	116.2	38	
60 min Summer	59.966	0.0	274.6	68	
120 min Summer	36.932	0.0	374.3	128	
180 min Summer	27.466	0.0	436.4	188	
240 min Summer	22.073	0.0	478.5	246	
360 min Summer	15.975	0.0	529.1	366	
480 min Summer	12.562	0.0	555.9	486	
600 min Summer	10.371	0.0	570.7	604	
720 min Summer	8.843	0.0	578.5	724	
960 min Summer	6.842	0.0	581.1	962	
1440 min Summer	4.743	0.0	562.2	1440	
2160 min Summer	3.288	0.0	940.1	1856	
2880 min Summer	2.547	0.0	935.8	2216	
4320 min Summer	1.811	0.0	900.3	2984	
5760 min Summer	1.443	0.0	1419.0	3800	
7200 min Summer	1.224	0.0	1472.8	4608	
8640 min Summer	1.080	0.0	1513.9	5440	
10080 min Summer	0.980	0.0	1535.8	6248	
15 min Winter	152.119	0.0	91.7	23	
30 min Winter	98.091	0.0	140.6	38	
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.072	0.072	2.8	901.9	O K
120 min Winter	0.088	0.088	3.9	1104.5	O K
180 min Winter	0.098	0.098	4.6	1224.5	O K
240 min Winter	0.104	0.104	5.0	1303.8	O K
360 min Winter	0.111	0.111	5.5	1397.7	O K
480 min Winter	0.115	0.115	5.7	1447.2	O K
600 min Winter	0.117	0.117	5.8	1475.0	O K
720 min Winter	0.119	0.119	5.9	1490.6	O K
960 min Winter	0.119	0.119	5.9	1500.6	O K
1440 min Winter	0.118	0.118	5.9	1488.2	O K
2160 min Winter	0.115	0.115	5.7	1446.7	O K
2880 min Winter	0.113	0.113	5.6	1419.3	O K
4320 min Winter	0.111	0.111	5.5	1395.6	O K
5760 min Winter	0.110	0.110	5.4	1380.2	O K
7200 min Winter	0.109	0.109	5.4	1369.8	O K
8640 min Winter	0.109	0.109	5.3	1363.5	O K
10080 min Winter	0.108	0.108	5.3	1360.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	327.0	68	
120 min Winter	36.932	0.0	442.5	126	
180 min Winter	27.466	0.0	513.7	184	
240 min Winter	22.073	0.0	561.6	244	
360 min Winter	15.975	0.0	618.6	360	
480 min Winter	12.562	0.0	648.4	478	
600 min Winter	10.371	0.0	664.5	594	
720 min Winter	8.843	0.0	672.7	710	
960 min Winter	6.842	0.0	674.6	940	
1440 min Winter	4.743	0.0	651.1	1386	
2160 min Winter	3.288	0.0	1085.2	2008	
2880 min Winter	2.547	0.0	1080.3	2252	
4320 min Winter	1.811	0.0	1039.1	3160	
5760 min Winter	1.443	0.0	1622.0	4040	
7200 min Winter	1.224	0.0	1684.2	4904	
8640 min Winter	1.080	0.0	1732.0	5792	
10080 min Winter	0.980	0.0	1757.5	6648	
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Date 22/02/2021 09:19 File CATCHMENT 6.SRCX	Designed by UKOEP001 Checked by	
XP Solutions Source Control 2019.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.800

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.900	4 8	0.900

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WSP Group Ltd		Page 4																																																																																																			
		Micro Drainage																																																																																																			
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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0132-7200-0500-7200 Design Head (m) 0.500 Design Flow (l/s) 7.2 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 132 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>7.2</td></tr><tr><td>Flush-Flo™</td><td>0.203</td><td>7.2</td></tr><tr><td>Kick-Flo®</td><td>0.384</td><td>6.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>5.8</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.7</td><td>1.200</td><td>10.9</td><td>3.000</td><td>16.8</td><td>7.000</td><td>25.3</td></tr><tr><td>0.200</td><td>7.2</td><td>1.400</td><td>11.7</td><td>3.500</td><td>18.1</td><td>7.500</td><td>26.2</td></tr><tr><td>0.300</td><td>7.0</td><td>1.600</td><td>12.4</td><td>4.000</td><td>19.3</td><td>8.000</td><td>27.0</td></tr><tr><td>0.400</td><td>6.5</td><td>1.800</td><td>13.2</td><td>4.500</td><td>20.4</td><td>8.500</td><td>27.9</td></tr><tr><td>0.500</td><td>7.2</td><td>2.000</td><td>13.8</td><td>5.000</td><td>21.5</td><td>9.000</td><td>28.7</td></tr><tr><td>0.600</td><td>7.8</td><td>2.200</td><td>14.5</td><td>5.500</td><td>22.4</td><td>9.500</td><td>29.5</td></tr><tr><td>0.800</td><td>9.0</td><td>2.400</td><td>15.1</td><td>6.000</td><td>23.4</td><td></td><td></td></tr><tr><td>1.000</td><td>10.0</td><td>2.600</td><td>15.7</td><td>6.500</td><td>24.3</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	7.2	Flush-Flo™	0.203	7.2	Kick-Flo®	0.384	6.4	Mean Flow over Head Range	-	5.8	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.7	1.200	10.9	3.000	16.8	7.000	25.3	0.200	7.2	1.400	11.7	3.500	18.1	7.500	26.2	0.300	7.0	1.600	12.4	4.000	19.3	8.000	27.0	0.400	6.5	1.800	13.2	4.500	20.4	8.500	27.9	0.500	7.2	2.000	13.8	5.000	21.5	9.000	28.7	0.600	7.8	2.200	14.5	5.500	22.4	9.500	29.5	0.800	9.0	2.400	15.1	6.000	23.4			1.000	10.0	2.600	15.7	6.500	24.3		
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<table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>0.070</td><td>0.070</td><td>3.2</td><td>882.3</td><td>O K</td></tr><tr><td>30 min Summer</td><td>0.090</td><td>0.090</td><td>5.0</td><td>1135.5</td><td>O K</td></tr><tr><td>60 min Summer</td><td>0.110</td><td>0.110</td><td>6.9</td><td>1382.1</td><td>O K</td></tr><tr><td>120 min Summer</td><td>0.134</td><td>0.134</td><td>9.3</td><td>1686.2</td><td>O K</td></tr><tr><td>180 min Summer</td><td>0.148</td><td>0.148</td><td>10.5</td><td>1863.2</td><td>O K</td></tr><tr><td>240 min Summer</td><td>0.157</td><td>0.157</td><td>11.2</td><td>1977.6</td><td>O K</td></tr><tr><td>360 min Summer</td><td>0.167</td><td>0.167</td><td>12.0</td><td>2106.7</td><td>O K</td></tr><tr><td>480 min Summer</td><td>0.172</td><td>0.172</td><td>12.1</td><td>2168.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>0.174</td><td>0.174</td><td>12.1</td><td>2197.1</td><td>O K</td></tr><tr><td>720 min Summer</td><td>0.175</td><td>0.175</td><td>12.1</td><td>2207.3</td><td>O K</td></tr><tr><td>960 min Summer</td><td>0.174</td><td>0.174</td><td>12.1</td><td>2194.9</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>0.169</td><td>0.169</td><td>12.1</td><td>2131.0</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>0.164</td><td>0.164</td><td>11.8</td><td>2069.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>0.161</td><td>0.161</td><td>11.5</td><td>2029.5</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>0.158</td><td>0.158</td><td>11.3</td><td>1985.5</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>0.155</td><td>0.155</td><td>11.1</td><td>1958.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>0.154</td><td>0.154</td><td>11.0</td><td>1939.4</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>0.153</td><td>0.153</td><td>10.9</td><td>1927.8</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>0.153</td><td>0.153</td><td>10.9</td><td>1921.2</td><td>O K</td></tr><tr><td>15 min Winter</td><td>0.079</td><td>0.079</td><td>3.9</td><td>988.0</td><td>O K</td></tr><tr><td>30 min Winter</td><td>0.101</td><td>0.101</td><td>6.1</td><td>1271.3</td><td>O K</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	0.070	0.070	3.2	882.3	O K	30 min Summer	0.090	0.090	5.0	1135.5	O K	60 min Summer	0.110	0.110	6.9	1382.1	O K	120 min Summer	0.134	0.134	9.3	1686.2	O K	180 min Summer	0.148	0.148	10.5	1863.2	O K	240 min Summer	0.157	0.157	11.2	1977.6	O K	360 min Summer	0.167	0.167	12.0	2106.7	O K	480 min Summer	0.172	0.172	12.1	2168.2	O K	600 min Summer	0.174	0.174	12.1	2197.1	O K	720 min Summer	0.175	0.175	12.1	2207.3	O K	960 min Summer	0.174	0.174	12.1	2194.9	O K	1440 min Summer	0.169	0.169	12.1	2131.0	O K	2160 min Summer	0.164	0.164	11.8	2069.2	O K	2880 min Summer	0.161	0.161	11.5	2029.5	O K	4320 min Summer	0.158	0.158	11.3	1985.5	O K	5760 min Summer	0.155	0.155	11.1	1958.1	O K	7200 min Summer	0.154	0.154	11.0	1939.4	O K	8640 min Summer	0.153	0.153	10.9	1927.8	O K	10080 min Summer	0.153	0.153	10.9	1921.2	O K	15 min Winter	0.079	0.079	3.9	988.0	O K	30 min Winter	0.101	0.101	6.1	1271.3	O K
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1440 min Summer	4.743	0.0	1318.9	1244																																																																																																																																						
2160 min Summer	3.288	0.0	1998.6	1600																																																																																																																																						
2880 min Summer	2.547	0.0	2010.4	1992																																																																																																																																						
4320 min Summer	1.811	0.0	1983.2	2812																																																																																																																																						
5760 min Summer	1.443	0.0	2763.1	3632																																																																																																																																						
7200 min Summer	1.224	0.0	2889.2	4400																																																																																																																																						
8640 min Summer	1.080	0.0	2998.0	5192																																																																																																																																						
10080 min Summer	0.980	0.0	3076.3	5960																																																																																																																																						
15 min Winter	152.119	0.0	258.9	23																																																																																																																																						
30 min Winter	98.091	0.0	384.5	38																																																																																																																																						
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XP Solutions			Source Control 2019.1		
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.123	0.123	8.2	1547.2	O K
120 min Winter	0.150	0.150	10.6	1888.1	O K
180 min Winter	0.166	0.166	11.9	2086.9	O K
240 min Winter	0.176	0.176	12.1	2216.2	O K
360 min Winter	0.188	0.188	12.2	2365.7	O K
480 min Winter	0.193	0.193	12.3	2439.9	O K
600 min Winter	0.196	0.196	12.3	2477.0	O K
720 min Winter	0.198	0.198	12.3	2493.2	O K
960 min Winter	0.197	0.197	12.3	2489.3	O K
1440 min Winter	0.192	0.192	12.2	2425.6	O K
2160 min Winter	0.184	0.184	12.2	2319.5	O K
2880 min Winter	0.179	0.179	12.1	2250.5	O K
4320 min Winter	0.171	0.171	12.1	2151.3	O K
5760 min Winter	0.165	0.165	11.8	2079.3	O K
7200 min Winter	0.161	0.161	11.5	2024.1	O K
8640 min Winter	0.157	0.157	11.2	1981.1	O K
10080 min Winter	0.155	0.155	11.0	1947.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	799.4	66	
120 min Winter	36.932	0.0	1050.3	126	
180 min Winter	27.466	0.0	1200.6	184	
240 min Winter	22.073	0.0	1299.3	242	
360 min Winter	15.975	0.0	1412.4	360	
480 min Winter	12.562	0.0	1469.4	476	
600 min Winter	10.371	0.0	1499.5	592	
720 min Winter	8.843	0.0	1514.3	708	
960 min Winter	6.842	0.0	1516.5	934	
1440 min Winter	4.743	0.0	1469.3	1370	
2160 min Winter	3.288	0.0	2270.9	1692	
2880 min Winter	2.547	0.0	2286.9	2136	
4320 min Winter	1.811	0.0	2258.5	3028	
5760 min Winter	1.443	0.0	3131.8	3864	
7200 min Winter	1.224	0.0	3276.7	4688	
8640 min Winter	1.080	0.0	3402.4	5536	
10080 min Winter	0.980	0.0	3493.9	6352	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.100

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 1.550	4	8 1.550

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0167-1240-0500-1240
Design Head (m)	0.500
Design Flow (l/s)	12.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	167
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	12.4
Flush-Flo™	0.242	12.4
Kick-Flo®	0.405	11.2
Mean Flow over Head Range	-	9.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.9	1.200	18.8	3.000	29.1	7.000	43.9
0.200	12.3	1.400	20.2	3.500	31.4	7.500	45.4
0.300	12.3	1.600	21.5	4.000	33.5	8.000	46.9
0.400	11.3	1.800	22.8	4.500	35.4	8.500	48.4
0.500	12.4	2.000	24.0	5.000	37.3	9.000	49.8
0.600	13.5	2.200	25.1	5.500	38.8	9.500	51.2
0.800	15.5	2.400	26.2	6.000	40.6		
1.000	17.2	2.600	27.2	6.500	42.3		

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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.097	0.097	5.1	1215.2	O K
120 min Winter	0.118	0.118	6.9	1485.4	O K
180 min Winter	0.131	0.131	7.9	1644.0	O K
240 min Winter	0.139	0.139	8.4	1747.7	O K
360 min Winter	0.148	0.148	9.1	1868.0	O K
480 min Winter	0.153	0.153	9.4	1928.3	O K
600 min Winter	0.156	0.156	9.4	1959.7	O K
720 min Winter	0.157	0.157	9.5	1974.9	O K
960 min Winter	0.157	0.157	9.5	1977.1	O K
1440 min Winter	0.154	0.154	9.4	1939.4	O K
2160 min Winter	0.149	0.149	9.1	1870.1	O K
2880 min Winter	0.145	0.145	8.9	1829.9	O K
4320 min Winter	0.141	0.141	8.6	1775.7	O K
5760 min Winter	0.138	0.138	8.4	1735.5	O K
7200 min Winter	0.136	0.136	8.2	1705.0	O K
8640 min Winter	0.134	0.134	8.1	1681.8	O K
10080 min Winter	0.132	0.132	8.0	1664.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	541.9	68	
120 min Winter	36.932	0.0	721.5	126	
180 min Winter	27.466	0.0	830.5	184	
240 min Winter	22.073	0.0	903.0	242	
360 min Winter	15.975	0.0	988.7	360	
480 min Winter	12.562	0.0	1033.5	476	
600 min Winter	10.371	0.0	1058.0	592	
720 min Winter	8.843	0.0	1070.5	708	
960 min Winter	6.842	0.0	1074.2	934	
1440 min Winter	4.743	0.0	1041.2	1370	
2160 min Winter	3.288	0.0	1650.0	1728	
2880 min Winter	2.547	0.0	1652.0	2168	
4320 min Winter	1.811	0.0	1610.6	3072	
5760 min Winter	1.443	0.0	2349.4	3976	
7200 min Winter	1.224	0.0	2450.2	4824	
8640 min Winter	1.080	0.0	2533.9	5624	
10080 min Winter	0.980	0.0	2588.9	6456	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.430

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	1.215	4 8	1.215

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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.117	0.117	9.2	1466.3	O K
30 min Summer	0.150	0.150	13.8	1884.4	O K
60 min Summer	0.181	0.181	17.8	2288.2	O K
120 min Summer	0.220	0.220	20.2	2783.2	O K
180 min Summer	0.243	0.243	20.4	3071.9	O K
240 min Summer	0.257	0.257	20.5	3258.2	O K
360 min Summer	0.274	0.274	20.6	3467.0	O K
480 min Summer	0.281	0.281	20.6	3563.5	O K
600 min Summer	0.284	0.284	20.6	3604.3	O K
720 min Summer	0.285	0.285	20.6	3613.6	O K
960 min Summer	0.282	0.282	20.6	3576.3	O K
1440 min Summer	0.272	0.272	20.6	3440.6	O K
2160 min Summer	0.260	0.260	20.5	3294.8	O K
2880 min Summer	0.252	0.252	20.5	3188.9	O K
4320 min Summer	0.241	0.241	20.4	3044.7	O K
5760 min Summer	0.232	0.232	20.4	2935.8	O K
7200 min Summer	0.226	0.226	20.3	2850.5	O K
8640 min Summer	0.220	0.220	20.2	2784.0	O K
10080 min Summer	0.216	0.216	20.2	2733.4	O K
15 min Winter	0.131	0.131	11.2	1641.8	O K
30 min Winter	0.167	0.167	16.1	2110.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	537.6	23	
30 min Summer	98.091	0.0	778.5	38	
60 min Summer	59.966	0.0	1468.0	68	
120 min Summer	36.932	0.0	1891.4	126	
180 min Summer	27.466	0.0	2136.6	186	
240 min Summer	22.073	0.0	2295.3	246	
360 min Summer	15.975	0.0	2478.6	366	
480 min Summer	12.562	0.0	2572.6	484	
600 min Summer	10.371	0.0	2623.2	604	
720 min Summer	8.843	0.0	2649.1	722	
960 min Summer	6.842	0.0	2656.1	960	
1440 min Summer	4.743	0.0	2582.5	1230	
2160 min Summer	3.288	0.0	3752.1	1564	
2880 min Summer	2.547	0.0	3806.3	1964	
4320 min Summer	1.811	0.0	3839.0	2768	
5760 min Summer	1.443	0.0	4917.2	3576	
7200 min Summer	1.224	0.0	5168.3	4328	
8640 min Summer	1.080	0.0	5399.0	5104	
10080 min Summer	0.980	0.0	5587.5	5856	
15 min Winter	152.119	0.0	636.8	23	
30 min Winter	98.091	0.0	912.7	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.203	0.203	20.0	2562.8	O K
120 min Winter	0.247	0.247	20.5	3123.1	O K
180 min Winter	0.273	0.273	20.6	3450.9	O K
240 min Winter	0.289	0.289	20.6	3663.6	O K
360 min Winter	0.308	0.308	20.6	3905.2	O K
480 min Winter	0.317	0.317	20.6	4020.8	O K
600 min Winter	0.321	0.321	20.6	4074.5	O K
720 min Winter	0.322	0.322	20.6	4093.2	O K
960 min Winter	0.321	0.321	20.6	4069.6	O K
1440 min Winter	0.310	0.310	20.6	3928.8	O K
2160 min Winter	0.292	0.292	20.6	3704.9	O K
2880 min Winter	0.280	0.280	20.6	3542.6	O K
4320 min Winter	0.260	0.260	20.5	3288.6	O K
5760 min Winter	0.244	0.244	20.5	3083.5	O K
7200 min Winter	0.231	0.231	20.3	2916.5	O K
8640 min Winter	0.220	0.220	20.2	2782.1	O K
10080 min Winter	0.212	0.212	20.1	2675.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	1692.9	66	
120 min Winter	36.932	0.0	2155.3	124	
180 min Winter	27.466	0.0	2416.2	184	
240 min Winter	22.073	0.0	2581.0	242	
360 min Winter	15.975	0.0	2763.9	360	
480 min Winter	12.562	0.0	2850.5	476	
600 min Winter	10.371	0.0	2891.4	592	
720 min Winter	8.843	0.0	2906.3	708	
960 min Winter	6.842	0.0	2890.3	934	
1440 min Winter	4.743	0.0	2766.6	1368	
2160 min Winter	3.288	0.0	4218.6	1688	
2880 min Winter	2.547	0.0	4273.6	2136	
4320 min Winter	1.811	0.0	4294.8	3024	
5760 min Winter	1.443	0.0	5542.8	3856	
7200 min Winter	1.224	0.0	5830.7	4680	
8640 min Winter	1.080	0.0	6097.2	5440	
10080 min Winter	0.980	0.0	6318.6	6160	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.160

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 2.580	From: To:	(ha)
		4	8 2.580

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0207-2060-0500-2060
Design Head (m)	0.500
Design Flow (l/s)	20.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	207
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	20.6
Flush-Flo™	0.287	20.6
Kick-Flo®	0.432	19.2
Mean Flow over Head Range	-	15.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.1	1.200	31.3	3.000	48.7	7.000	73.3
0.200	19.9	1.400	33.7	3.500	52.5	7.500	75.9
0.300	20.6	1.600	35.9	4.000	56.0	8.000	78.4
0.400	19.8	1.800	38.0	4.500	59.3	8.500	80.9
0.500	20.6	2.000	40.0	5.000	62.4	9.000	83.2
0.600	22.5	2.200	41.9	5.500	64.8	9.500	85.5
0.800	25.8	2.400	43.7	6.000	67.8		
1.000	28.7	2.600	45.4	6.500	70.6		

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Summary of Results for 100 year Return Period (+40%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
15 min Summer	0.071	0.071	3.3	896.5	O K	
30 min Summer	0.092	0.092	5.2	1153.7	O K	
60 min Summer	0.112	0.112	7.2	1404.2	O K	
120 min Summer	0.136	0.136	9.6	1712.9	O K	
180 min Summer	0.150	0.150	10.8	1892.5	O K	
240 min Summer	0.159	0.159	11.5	2008.5	O K	
360 min Summer	0.170	0.170	12.2	2139.2	O K	
480 min Summer	0.175	0.175	12.3	2201.7	O K	
600 min Summer	0.177	0.177	12.3	2230.9	O K	
720 min Summer	0.178	0.178	12.3	2241.1	O K	
960 min Summer	0.177	0.177	12.3	2228.1	O K	
1440 min Summer	0.172	0.172	12.3	2162.1	O K	
2160 min Summer	0.167	0.167	12.1	2098.0	O K	
2880 min Summer	0.163	0.163	11.8	2057.2	O K	
4320 min Summer	0.160	0.160	11.5	2011.2	O K	
5760 min Summer	0.157	0.157	11.4	1982.1	O K	
7200 min Summer	0.156	0.156	11.2	1962.4	O K	
8640 min Summer	0.155	0.155	11.2	1949.7	O K	
10080 min Summer	0.154	0.154	11.1	1942.3	O K	
15 min Winter	0.080	0.080	4.1	1003.9	O K	
30 min Winter	0.103	0.103	6.3	1291.7	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	152.119	0.0	221.9	23		
30 min Summer	98.091	0.0	332.1	38		
60 min Summer	59.966	0.0	700.4	68		
120 min Summer	36.932	0.0	926.6	128		
180 min Summer	27.466	0.0	1064.0	186		
240 min Summer	22.073	0.0	1155.7	246		
360 min Summer	15.975	0.0	1265.4	366		
480 min Summer	12.562	0.0	1323.2	484		
600 min Summer	10.371	0.0	1355.5	604		
720 min Summer	8.843	0.0	1373.0	722		
960 min Summer	6.842	0.0	1381.8	962		
1440 min Summer	4.743	0.0	1349.8	1244		
2160 min Summer	3.288	0.0	2041.3	1596		
2880 min Summer	2.547	0.0	2054.0	1988		
4320 min Summer	1.811	0.0	2027.7	2808		
5760 min Summer	1.443	0.0	2815.5	3632		
7200 min Summer	1.224	0.0	2944.6	4400		
8640 min Summer	1.080	0.0	3056.2	5192		
10080 min Summer	0.980	0.0	3137.0	5960		
15 min Winter	152.119	0.0	266.7	23		
30 min Winter	98.091	0.0	395.7	37		
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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.125	0.125	8.5	1571.9	O K
120 min Winter	0.152	0.152	11.0	1918.1	O K
180 min Winter	0.168	0.168	12.2	2119.8	O K
240 min Winter	0.179	0.179	12.3	2251.2	O K
360 min Winter	0.191	0.191	12.4	2403.1	O K
480 min Winter	0.196	0.196	12.5	2478.3	O K
600 min Winter	0.199	0.199	12.5	2515.9	O K
720 min Winter	0.201	0.201	12.5	2532.1	O K
960 min Winter	0.200	0.200	12.5	2527.7	O K
1440 min Winter	0.195	0.195	12.4	2462.3	O K
2160 min Winter	0.187	0.187	12.4	2353.5	O K
2880 min Winter	0.181	0.181	12.3	2282.1	O K
4320 min Winter	0.173	0.173	12.3	2179.1	O K
5760 min Winter	0.167	0.167	12.1	2103.4	O K
7200 min Winter	0.162	0.162	11.7	2046.4	O K
8640 min Winter	0.159	0.159	11.5	2001.6	O K
10080 min Winter	0.156	0.156	11.3	1966.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	819.7	66	
120 min Winter	36.932	0.0	1076.0	126	
180 min Winter	27.466	0.0	1229.5	184	
240 min Winter	22.073	0.0	1329.8	242	
360 min Winter	15.975	0.0	1444.7	360	
480 min Winter	12.562	0.0	1502.5	476	
600 min Winter	10.371	0.0	1532.9	592	
720 min Winter	8.843	0.0	1547.8	708	
960 min Winter	6.842	0.0	1549.8	934	
1440 min Winter	4.743	0.0	1501.2	1370	
2160 min Winter	3.288	0.0	2317.6	1692	
2880 min Winter	2.547	0.0	2334.4	2136	
4320 min Winter	1.811	0.0	2307.7	3028	
5760 min Winter	1.443	0.0	3190.7	3864	
7200 min Winter	1.224	0.0	3338.8	4688	
8640 min Winter	1.080	0.0	3467.7	5528	
10080 min Winter	0.980	0.0	3562.4	6352	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.150

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	1.575	4 8	1.575

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		Micro Drainage																																																																																																			
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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0168-1260-0500-1260 Design Head (m) 0.500 Design Flow (l/s) 12.6 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 168 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>12.6</td></tr><tr><td>Flush-Flo™</td><td>0.245</td><td>12.6</td></tr><tr><td>Kick-Flo®</td><td>0.408</td><td>11.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>9.8</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>6.0</td><td>1.200</td><td>19.1</td><td>3.000</td><td>29.6</td><td>7.000</td><td>44.6</td></tr><tr><td>0.200</td><td>12.5</td><td>1.400</td><td>20.5</td><td>3.500</td><td>31.9</td><td>7.500</td><td>46.1</td></tr><tr><td>0.300</td><td>12.5</td><td>1.600</td><td>21.9</td><td>4.000</td><td>34.0</td><td>8.000</td><td>47.7</td></tr><tr><td>0.400</td><td>11.6</td><td>1.800</td><td>23.2</td><td>4.500</td><td>36.0</td><td>8.500</td><td>49.2</td></tr><tr><td>0.500</td><td>12.6</td><td>2.000</td><td>24.4</td><td>5.000</td><td>37.9</td><td>9.000</td><td>50.6</td></tr><tr><td>0.600</td><td>13.7</td><td>2.200</td><td>25.5</td><td>5.500</td><td>39.4</td><td>9.500</td><td>52.0</td></tr><tr><td>0.800</td><td>15.7</td><td>2.400</td><td>26.6</td><td>6.000</td><td>41.2</td><td></td><td></td></tr><tr><td>1.000</td><td>17.5</td><td>2.600</td><td>27.6</td><td>6.500</td><td>42.9</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3		Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	12.6	Flush-Flo™	0.245	12.6	Kick-Flo®	0.408	11.4	Mean Flow over Head Range	-	9.8	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.0	1.200	19.1	3.000	29.6	7.000	44.6	0.200	12.5	1.400	20.5	3.500	31.9	7.500	46.1	0.300	12.5	1.600	21.9	4.000	34.0	8.000	47.7	0.400	11.6	1.800	23.2	4.500	36.0	8.500	49.2	0.500	12.6	2.000	24.4	5.000	37.9	9.000	50.6	0.600	13.7	2.200	25.5	5.500	39.4	9.500	52.0	0.800	15.7	2.400	26.6	6.000	41.2			1.000	17.5	2.600	27.6	6.500	42.9		
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)																																																																																																
0.000	12500.0	0.700	13346.2	1.000	13717.3																																																																																																
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Design Point (Calculated)	0.500	12.6																																																																																																			
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Kick-Flo®	0.408	11.4																																																																																																			
Mean Flow over Head Range	-	9.8																																																																																																			
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																														
0.100	6.0	1.200	19.1	3.000	29.6	7.000	44.6																																																																																														
0.200	12.5	1.400	20.5	3.500	31.9	7.500	46.1																																																																																														
0.300	12.5	1.600	21.9	4.000	34.0	8.000	47.7																																																																																														
0.400	11.6	1.800	23.2	4.500	36.0	8.500	49.2																																																																																														
0.500	12.6	2.000	24.4	5.000	37.9	9.000	50.6																																																																																														
0.600	13.7	2.200	25.5	5.500	39.4	9.500	52.0																																																																																														
0.800	15.7	2.400	26.6	6.000	41.2																																																																																																
1.000	17.5	2.600	27.6	6.500	42.9																																																																																																
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XP Solutions			Source Control 2019.1		
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.151	0.151	15.6	1901.8	O K
30 min Summer	0.194	0.194	22.4	2442.0	O K
60 min Summer	0.234	0.234	26.2	2962.4	O K
120 min Summer	0.285	0.285	26.7	3605.6	O K
180 min Summer	0.314	0.314	26.8	3979.1	O K
240 min Summer	0.332	0.332	26.8	4219.4	O K
360 min Summer	0.353	0.353	26.8	4487.2	O K
480 min Summer	0.362	0.362	26.8	4608.9	O K
600 min Summer	0.366	0.366	26.8	4658.4	O K
720 min Summer	0.367	0.367	26.8	4666.7	O K
960 min Summer	0.363	0.363	26.8	4610.4	O K
1440 min Summer	0.348	0.348	26.8	4416.0	O K
2160 min Summer	0.331	0.331	26.8	4201.9	O K
2880 min Summer	0.318	0.318	26.8	4041.3	O K
4320 min Summer	0.301	0.301	26.8	3812.9	O K
5760 min Summer	0.287	0.287	26.7	3635.7	O K
7200 min Summer	0.276	0.276	26.6	3494.7	O K
8640 min Summer	0.267	0.267	26.6	3382.0	O K
10080 min Summer	0.260	0.260	26.5	3294.2	O K
15 min Winter	0.169	0.169	18.5	2129.3	O K
30 min Winter	0.217	0.217	25.5	2734.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	834.0	23	
30 min Summer	98.091	0.0	1185.9	38	
60 min Summer	59.966	0.0	2105.8	68	
120 min Summer	36.932	0.0	2669.6	126	
180 min Summer	27.466	0.0	2993.4	186	
240 min Summer	22.073	0.0	3201.7	246	
360 min Summer	15.975	0.0	3439.9	366	
480 min Summer	12.562	0.0	3559.4	484	
600 min Summer	10.371	0.0	3621.6	604	
720 min Summer	8.843	0.0	3651.1	722	
960 min Summer	6.842	0.0	3650.8	962	
1440 min Summer	4.743	0.0	3530.1	1230	
2160 min Summer	3.288	0.0	5085.2	1564	
2880 min Summer	2.547	0.0	5172.4	1964	
4320 min Summer	1.811	0.0	5257.7	2768	
5760 min Summer	1.443	0.0	6527.9	3568	
7200 min Summer	1.224	0.0	6874.5	4328	
8640 min Summer	1.080	0.0	7199.8	5104	
10080 min Summer	0.980	0.0	7477.1	5856	
15 min Winter	152.119	0.0	979.8	23	
30 min Winter	98.091	0.0	1377.7	37	
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.262	0.262	26.5	3321.8	O K
120 min Winter	0.319	0.319	26.8	4047.8	O K
180 min Winter	0.352	0.352	26.8	4471.5	O K
240 min Winter	0.373	0.373	26.8	4745.9	O K
360 min Winter	0.397	0.397	26.8	5056.6	O K
480 min Winter	0.408	0.408	26.8	5203.5	O K
600 min Winter	0.413	0.413	26.8	5270.2	O K
720 min Winter	0.415	0.415	26.8	5291.1	O K
960 min Winter	0.412	0.412	26.8	5253.0	O K
1440 min Winter	0.397	0.397	26.8	5052.7	O K
2160 min Winter	0.372	0.372	26.8	4727.4	O K
2880 min Winter	0.353	0.353	26.8	4487.7	O K
4320 min Winter	0.323	0.323	26.8	4105.5	O K
5760 min Winter	0.299	0.299	26.8	3793.7	O K
7200 min Winter	0.279	0.279	26.7	3538.4	O K
8640 min Winter	0.263	0.263	26.5	3330.8	O K
10080 min Winter	0.250	0.250	26.4	3164.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2406.1	66	
120 min Winter	36.932	0.0	3017.0	124	
180 min Winter	27.466	0.0	3358.2	184	
240 min Winter	22.073	0.0	3570.5	242	
360 min Winter	15.975	0.0	3798.8	360	
480 min Winter	12.562	0.0	3899.3	476	
600 min Winter	10.371	0.0	3939.6	592	
720 min Winter	8.843	0.0	3946.3	708	
960 min Winter	6.842	0.0	3900.9	934	
1440 min Winter	4.743	0.0	3691.9	1370	
2160 min Winter	3.288	0.0	5700.9	1692	
2880 min Winter	2.547	0.0	5790.7	2136	
4320 min Winter	1.811	0.0	5855.3	3024	
5760 min Winter	1.443	0.0	7345.8	3856	
7200 min Winter	1.224	0.0	7742.1	4616	
8640 min Winter	1.080	0.0	8116.8	5440	
10080 min Winter	0.980	0.0	8441.8	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.700

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	3.350	4 8	3.350

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		Micro Drainage																																																																																																			
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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0232-2680-0500-2680 Design Head (m) 0.500 Design Flow (l/s) 26.8 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 232 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 300 Suggested Manhole Diameter (mm) 1500 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>26.8</td></tr><tr><td>Flush-Flo™</td><td>0.313</td><td>26.8</td></tr><tr><td>Kick-Flo®</td><td>0.445</td><td>25.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>19.4</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.7</td><td>1.200</td><td>40.8</td><td>3.000</td><td>63.5</td><td>7.000</td><td>95.6</td></tr><tr><td>0.200</td><td>23.3</td><td>1.400</td><td>43.9</td><td>3.500</td><td>68.5</td><td>7.500</td><td>99.0</td></tr><tr><td>0.300</td><td>26.8</td><td>1.600</td><td>46.9</td><td>4.000</td><td>73.1</td><td>8.000</td><td>102.3</td></tr><tr><td>0.400</td><td>26.2</td><td>1.800</td><td>49.6</td><td>4.500</td><td>77.4</td><td>8.500</td><td>105.5</td></tr><tr><td>0.500</td><td>26.8</td><td>2.000</td><td>52.2</td><td>5.000</td><td>81.5</td><td>9.000</td><td>108.6</td></tr><tr><td>0.600</td><td>29.2</td><td>2.200</td><td>54.7</td><td>5.500</td><td>84.6</td><td>9.500</td><td>111.6</td></tr><tr><td>0.800</td><td>33.6</td><td>2.400</td><td>57.0</td><td>6.000</td><td>88.4</td><td></td><td></td></tr><tr><td>1.000</td><td>37.4</td><td>2.600</td><td>59.3</td><td>6.500</td><td>92.1</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3		Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	26.8	Flush-Flo™	0.313	26.8	Kick-Flo®	0.445	25.4	Mean Flow over Head Range	-	19.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	7.7	1.200	40.8	3.000	63.5	7.000	95.6	0.200	23.3	1.400	43.9	3.500	68.5	7.500	99.0	0.300	26.8	1.600	46.9	4.000	73.1	8.000	102.3	0.400	26.2	1.800	49.6	4.500	77.4	8.500	105.5	0.500	26.8	2.000	52.2	5.000	81.5	9.000	108.6	0.600	29.2	2.200	54.7	5.500	84.6	9.500	111.6	0.800	33.6	2.400	57.0	6.000	88.4			1.000	37.4	2.600	59.3	6.500	92.1		
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)																																																																																																
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<u>Summary of Results for 100 year Return Period (+40%)</u>																																																																																																																																										
<table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>0.176</td><td>0.176</td><td>21.0</td><td>2212.2</td><td>O K</td></tr><tr><td>30 min Summer</td><td>0.225</td><td>0.225</td><td>29.2</td><td>2839.3</td><td>O K</td></tr><tr><td>60 min Summer</td><td>0.272</td><td>0.272</td><td>30.9</td><td>3445.0</td><td>O K</td></tr><tr><td>120 min Summer</td><td>0.330</td><td>0.330</td><td>31.3</td><td>4193.1</td><td>O K</td></tr><tr><td>180 min Summer</td><td>0.364</td><td>0.364</td><td>31.3</td><td>4626.9</td><td>O K</td></tr><tr><td>240 min Summer</td><td>0.385</td><td>0.385</td><td>31.3</td><td>4905.8</td><td>O K</td></tr><tr><td>360 min Summer</td><td>0.409</td><td>0.409</td><td>31.3</td><td>5216.0</td><td>O K</td></tr><tr><td>480 min Summer</td><td>0.420</td><td>0.420</td><td>31.3</td><td>5356.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>0.424</td><td>0.424</td><td>31.3</td><td>5412.2</td><td>O K</td></tr><tr><td>720 min Summer</td><td>0.425</td><td>0.425</td><td>31.3</td><td>5420.1</td><td>O K</td></tr><tr><td>960 min Summer</td><td>0.420</td><td>0.420</td><td>31.3</td><td>5350.5</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>0.401</td><td>0.401</td><td>31.3</td><td>5110.7</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>0.380</td><td>0.380</td><td>31.3</td><td>4842.4</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>0.365</td><td>0.365</td><td>31.3</td><td>4639.3</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>0.342</td><td>0.342</td><td>31.3</td><td>4345.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>0.324</td><td>0.324</td><td>31.3</td><td>4115.2</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>0.310</td><td>0.310</td><td>31.2</td><td>3931.9</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>0.298</td><td>0.298</td><td>31.2</td><td>3784.2</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>0.289</td><td>0.289</td><td>31.1</td><td>3668.4</td><td>O K</td></tr><tr><td>15 min Winter</td><td>0.196</td><td>0.196</td><td>24.7</td><td>2476.9</td><td>O K</td></tr><tr><td>30 min Winter</td><td>0.251</td><td>0.251</td><td>30.6</td><td>3181.1</td><td>O K</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	0.176	0.176	21.0	2212.2	O K	30 min Summer	0.225	0.225	29.2	2839.3	O K	60 min Summer	0.272	0.272	30.9	3445.0	O K	120 min Summer	0.330	0.330	31.3	4193.1	O K	180 min Summer	0.364	0.364	31.3	4626.9	O K	240 min Summer	0.385	0.385	31.3	4905.8	O K	360 min Summer	0.409	0.409	31.3	5216.0	O K	480 min Summer	0.420	0.420	31.3	5356.2	O K	600 min Summer	0.424	0.424	31.3	5412.2	O K	720 min Summer	0.425	0.425	31.3	5420.1	O K	960 min Summer	0.420	0.420	31.3	5350.5	O K	1440 min Summer	0.401	0.401	31.3	5110.7	O K	2160 min Summer	0.380	0.380	31.3	4842.4	O K	2880 min Summer	0.365	0.365	31.3	4639.3	O K	4320 min Summer	0.342	0.342	31.3	4345.2	O K	5760 min Summer	0.324	0.324	31.3	4115.2	O K	7200 min Summer	0.310	0.310	31.2	3931.9	O K	8640 min Summer	0.298	0.298	31.2	3784.2	O K	10080 min Summer	0.289	0.289	31.1	3668.4	O K	15 min Winter	0.196	0.196	24.7	2476.9	O K	30 min Winter	0.251	0.251	30.6	3181.1	O K
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15 min Winter	0.196	0.196	24.7	2476.9	O K																																																																																																																																					
30 min Winter	0.251	0.251	30.6	3181.1	O K																																																																																																																																					
<table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>152.119</td><td>0.0</td><td>1066.3</td><td>23</td></tr><tr><td>30 min Summer</td><td>98.091</td><td>0.0</td><td>1500.1</td><td>38</td></tr><tr><td>60 min Summer</td><td>59.966</td><td>0.0</td><td>2571.6</td><td>68</td></tr><tr><td>120 min Summer</td><td>36.932</td><td>0.0</td><td>3236.0</td><td>126</td></tr><tr><td>180 min Summer</td><td>27.466</td><td>0.0</td><td>3616.5</td><td>186</td></tr><tr><td>240 min Summer</td><td>22.073</td><td>0.0</td><td>3860.3</td><td>246</td></tr><tr><td>360 min Summer</td><td>15.975</td><td>0.0</td><td>4136.9</td><td>366</td></tr><tr><td>480 min Summer</td><td>12.562</td><td>0.0</td><td>4273.1</td><td>484</td></tr><tr><td>600 min Summer</td><td>10.371</td><td>0.0</td><td>4341.9</td><td>604</td></tr><tr><td>720 min Summer</td><td>8.843</td><td>0.0</td><td>4372.0</td><td>722</td></tr><tr><td>960 min Summer</td><td>6.842</td><td>0.0</td><td>4362.9</td><td>962</td></tr><tr><td>1440 min Summer</td><td>4.743</td><td>0.0</td><td>4200.5</td><td>1238</td></tr><tr><td>2160 min Summer</td><td>3.288</td><td>0.0</td><td>6044.6</td><td>1564</td></tr><tr><td>2880 min Summer</td><td>2.547</td><td>0.0</td><td>6157.8</td><td>1964</td></tr><tr><td>4320 min Summer</td><td>1.811</td><td>0.0</td><td>6284.9</td><td>2768</td></tr><tr><td>5760 min Summer</td><td>1.443</td><td>0.0</td><td>7678.4</td><td>3568</td></tr><tr><td>7200 min Summer</td><td>1.224</td><td>0.0</td><td>8093.6</td><td>4328</td></tr><tr><td>8640 min Summer</td><td>1.080</td><td>0.0</td><td>8487.6</td><td>5104</td></tr><tr><td>10080 min Summer</td><td>0.980</td><td>0.0</td><td>8830.2</td><td>5856</td></tr><tr><td>15 min Winter</td><td>152.119</td><td>0.0</td><td>1246.8</td><td>23</td></tr><tr><td>30 min Winter</td><td>98.091</td><td>0.0</td><td>1730.4</td><td>37</td></tr></table>							Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	152.119	0.0	1066.3	23	30 min Summer	98.091	0.0	1500.1	38	60 min Summer	59.966	0.0	2571.6	68	120 min Summer	36.932	0.0	3236.0	126	180 min Summer	27.466	0.0	3616.5	186	240 min Summer	22.073	0.0	3860.3	246	360 min Summer	15.975	0.0	4136.9	366	480 min Summer	12.562	0.0	4273.1	484	600 min Summer	10.371	0.0	4341.9	604	720 min Summer	8.843	0.0	4372.0	722	960 min Summer	6.842	0.0	4362.9	962	1440 min Summer	4.743	0.0	4200.5	1238	2160 min Summer	3.288	0.0	6044.6	1564	2880 min Summer	2.547	0.0	6157.8	1964	4320 min Summer	1.811	0.0	6284.9	2768	5760 min Summer	1.443	0.0	7678.4	3568	7200 min Summer	1.224	0.0	8093.6	4328	8640 min Summer	1.080	0.0	8487.6	5104	10080 min Summer	0.980	0.0	8830.2	5856	15 min Winter	152.119	0.0	1246.8	23	30 min Winter	98.091	0.0	1730.4	37																						
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.305	0.305	31.2	3864.1	O K
120 min Winter	0.370	0.370	31.3	4708.1	O K
180 min Winter	0.408	0.408	31.3	5200.5	O K
240 min Winter	0.433	0.433	31.3	5519.4	O K
360 min Winter	0.460	0.460	31.3	5880.0	O K
480 min Winter	0.473	0.473	31.3	6048.0	O K
600 min Winter	0.479	0.479	31.3	6122.1	O K
720 min Winter	0.480	0.480	31.3	6143.1	O K
960 min Winter	0.477	0.477	31.3	6094.5	O K
1440 min Winter	0.459	0.459	31.3	5859.5	O K
2160 min Winter	0.428	0.428	31.3	5454.5	O K
2880 min Winter	0.405	0.405	31.3	5154.7	O K
4320 min Winter	0.367	0.367	31.3	4673.2	O K
5760 min Winter	0.337	0.337	31.3	4279.2	O K
7200 min Winter	0.312	0.312	31.2	3957.3	O K
8640 min Winter	0.292	0.292	31.1	3694.6	O K
10080 min Winter	0.275	0.275	31.0	3485.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2925.3	66	
120 min Winter	36.932	0.0	3643.6	124	
180 min Winter	27.466	0.0	4041.8	184	
240 min Winter	22.073	0.0	4286.1	242	
360 min Winter	15.975	0.0	4541.7	360	
480 min Winter	12.562	0.0	4649.2	476	
600 min Winter	10.371	0.0	4686.9	592	
720 min Winter	8.843	0.0	4684.9	708	
960 min Winter	6.842	0.0	4609.0	934	
1440 min Winter	4.743	0.0	4319.6	1370	
2160 min Winter	3.288	0.0	6766.4	1704	
2880 min Winter	2.547	0.0	6883.8	2136	
4320 min Winter	1.811	0.0	6987.0	3024	
5760 min Winter	1.443	0.0	8633.6	3856	
7200 min Winter	1.224	0.0	9107.8	4616	
8640 min Winter	1.080	0.0	9560.8	5368	
10080 min Winter	0.980	0.0	9961.6	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 7.800

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	3.900	4 8	3.900

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0248-3130-0500-3130
Design Head (m)	0.500
Design Flow (l/s)	31.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	248
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	31.3
Flush-Flo™	0.329	31.3
Kick-Flo®	0.453	29.9
Mean Flow over Head Range	-	22.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.1	1.200	47.7	3.000	74.3	7.000	111.8
0.200	25.3	1.400	51.3	3.500	80.1	7.500	115.8
0.300	31.2	1.600	54.8	4.000	85.5	8.000	119.7
0.400	30.8	1.800	58.0	4.500	90.5	8.500	123.4
0.500	31.3	2.000	61.0	5.000	95.3	9.000	127.0
0.600	34.1	2.200	63.9	5.500	98.9	9.500	130.6
0.800	39.2	2.400	66.7	6.000	103.4		
1.000	43.6	2.600	69.3	6.500	107.7		

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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.173	0.173	20.4	2184.0	O K
30 min Summer	0.222	0.222	28.5	2803.2	O K
60 min Summer	0.269	0.269	30.4	3401.2	O K
120 min Summer	0.326	0.326	30.8	4139.9	O K
180 min Summer	0.359	0.359	30.8	4568.3	O K
240 min Summer	0.381	0.381	30.8	4843.9	O K
360 min Summer	0.404	0.404	30.8	5150.4	O K
480 min Summer	0.415	0.415	30.8	5289.1	O K
600 min Summer	0.419	0.419	30.8	5344.7	O K
720 min Summer	0.420	0.420	30.8	5352.8	O K
960 min Summer	0.415	0.415	30.8	5284.9	O K
1440 min Summer	0.396	0.396	30.8	5049.4	O K
2160 min Summer	0.376	0.376	30.8	4786.2	O K
2880 min Summer	0.361	0.361	30.8	4587.5	O K
4320 min Summer	0.339	0.339	30.8	4300.0	O K
5760 min Summer	0.321	0.321	30.8	4075.2	O K
7200 min Summer	0.307	0.307	30.8	3896.4	O K
8640 min Summer	0.296	0.296	30.7	3752.1	O K
10080 min Summer	0.287	0.287	30.6	3639.0	O K
15 min Winter	0.194	0.194	24.1	2445.3	O K
30 min Winter	0.248	0.248	30.1	3140.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	1044.1	23	
30 min Summer	98.091	0.0	1470.1	38	
60 min Summer	59.966	0.0	2528.3	68	
120 min Summer	36.932	0.0	3183.0	126	
180 min Summer	27.466	0.0	3558.0	186	
240 min Summer	22.073	0.0	3798.3	246	
360 min Summer	15.975	0.0	4070.8	366	
480 min Summer	12.562	0.0	4205.0	484	
600 min Summer	10.371	0.0	4272.8	604	
720 min Summer	8.843	0.0	4302.6	722	
960 min Summer	6.842	0.0	4293.8	962	
1440 min Summer	4.743	0.0	4134.3	1238	
2160 min Summer	3.288	0.0	5955.6	1576	
2880 min Summer	2.547	0.0	6066.0	1964	
4320 min Summer	1.811	0.0	6188.1	2768	
5760 min Summer	1.443	0.0	7573.2	3568	
7200 min Summer	1.224	0.0	7982.2	4328	
8640 min Summer	1.080	0.0	8369.7	5104	
10080 min Summer	0.980	0.0	8706.4	5856	
15 min Winter	152.119	0.0	1221.4	23	
30 min Winter	98.091	0.0	1697.0	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.301	0.301	30.7	3814.9	O K
120 min Winter	0.365	0.365	30.8	4648.3	O K
180 min Winter	0.403	0.403	30.8	5134.5	O K
240 min Winter	0.427	0.427	30.8	5449.4	O K
360 min Winter	0.455	0.455	30.8	5806.1	O K
480 min Winter	0.467	0.467	30.8	5973.0	O K
600 min Winter	0.473	0.473	30.8	6047.0	O K
720 min Winter	0.475	0.475	30.8	6068.7	O K
960 min Winter	0.471	0.471	30.8	6022.1	O K
1440 min Winter	0.453	0.453	30.8	5789.8	O K
2160 min Winter	0.423	0.423	30.8	5391.0	O K
2880 min Winter	0.400	0.400	30.8	5097.3	O K
4320 min Winter	0.364	0.364	30.8	4626.1	O K
5760 min Winter	0.334	0.334	30.8	4240.4	O K
7200 min Winter	0.309	0.309	30.8	3924.6	O K
8640 min Winter	0.289	0.289	30.7	3667.3	O K
10080 min Winter	0.273	0.273	30.5	3462.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2876.8	66	
120 min Winter	36.932	0.0	3584.7	124	
180 min Winter	27.466	0.0	3977.2	184	
240 min Winter	22.073	0.0	4218.2	242	
360 min Winter	15.975	0.0	4470.2	360	
480 min Winter	12.562	0.0	4575.3	476	
600 min Winter	10.371	0.0	4612.0	592	
720 min Winter	8.843	0.0	4609.6	708	
960 min Winter	6.842	0.0	4534.9	934	
1440 min Winter	4.743	0.0	4253.5	1372	
2160 min Winter	3.288	0.0	6667.3	1704	
2880 min Winter	2.547	0.0	6781.6	2136	
4320 min Winter	1.811	0.0	6879.2	3024	
5760 min Winter	1.443	0.0	8515.9	3856	
7200 min Winter	1.224	0.0	8982.9	4616	
8640 min Winter	1.080	0.0	9428.7	5440	
10080 min Winter	0.980	0.0	9822.3	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 7.700

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 3.850	4	8 3.850

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0246-3080-0500-3080
Design Head (m)	0.500
Design Flow (l/s)	30.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	246
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	30.8
Flush-Flo™	0.327	30.8
Kick-Flo®	0.453	29.4
Mean Flow over Head Range	-	21.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	1.200	46.9	3.000	73.1	7.000	110.0
0.200	25.1	1.400	50.5	3.500	78.8	7.500	114.0
0.300	30.7	1.600	53.9	4.000	84.1	8.000	117.8
0.400	30.3	1.800	57.1	4.500	89.1	8.500	121.4
0.500	30.8	2.000	60.1	5.000	93.8	9.000	125.0
0.600	33.6	2.200	62.9	5.500	97.3	9.500	128.5
0.800	38.6	2.400	65.6	6.000	101.7		
1.000	43.0	2.600	68.2	6.500	106.0		

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XP Solutions			Source Control 2019.1		
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.266	0.266	27.0	3371.1	O K
120 min Winter	0.324	0.324	27.2	4107.8	O K
180 min Winter	0.357	0.357	27.2	4537.7	O K
240 min Winter	0.378	0.378	27.2	4816.0	O K
360 min Winter	0.403	0.403	27.2	5131.2	O K
480 min Winter	0.414	0.414	27.2	5280.0	O K
600 min Winter	0.419	0.419	27.2	5347.4	O K
720 min Winter	0.421	0.421	27.2	5368.4	O K
960 min Winter	0.418	0.418	27.2	5329.2	O K
1440 min Winter	0.402	0.402	27.2	5124.6	O K
2160 min Winter	0.377	0.377	27.2	4792.6	O K
2880 min Winter	0.358	0.358	27.2	4547.8	O K
4320 min Winter	0.327	0.327	27.2	4156.8	O K
5760 min Winter	0.303	0.303	27.2	3838.0	O K
7200 min Winter	0.282	0.282	27.1	3577.0	O K
8640 min Winter	0.266	0.266	27.0	3364.5	O K
10080 min Winter	0.253	0.253	26.8	3195.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2453.0	66	
120 min Winter	36.932	0.0	3073.7	124	
180 min Winter	27.466	0.0	3420.3	184	
240 min Winter	22.073	0.0	3635.8	242	
360 min Winter	15.975	0.0	3867.1	360	
480 min Winter	12.562	0.0	3968.5	476	
600 min Winter	10.371	0.0	4008.8	592	
720 min Winter	8.843	0.0	4014.9	708	
960 min Winter	6.842	0.0	3967.3	934	
1440 min Winter	4.743	0.0	3752.8	1370	
2160 min Winter	3.288	0.0	5798.1	1692	
2880 min Winter	2.547	0.0	5890.4	2136	
4320 min Winter	1.811	0.0	5958.4	3024	
5760 min Winter	1.443	0.0	7462.9	3856	
7200 min Winter	1.224	0.0	7866.2	4616	
8640 min Winter	1.080	0.0	8248.0	5440	
10080 min Winter	0.980	0.0	8580.0	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.800

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 3.400	4	8 3.400

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0233-2720-0500-2720
Design Head (m)	0.500
Design Flow (l/s)	27.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	233
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	27.2
Flush-Flo™	0.315	27.2
Kick-Flo®	0.447	25.8
Mean Flow over Head Range	-	19.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	41.4	3.000	64.5	7.000	97.1
0.200	23.5	1.400	44.6	3.500	69.5	7.500	100.5
0.300	27.2	1.600	47.6	4.000	74.2	8.000	103.9
0.400	26.6	1.800	50.3	4.500	78.6	8.500	107.1
0.500	27.2	2.000	53.0	5.000	82.7	9.000	110.3
0.600	29.7	2.200	55.5	5.500	85.8	9.500	113.3
0.800	34.1	2.400	57.9	6.000	89.7		
1.000	37.9	2.600	60.2	6.500	93.5		

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XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.343	0.343	60.4	4363.4	O K
30 min Summer	0.439	0.439	61.7	5604.4	O K
60 min Summer	0.531	0.531	61.8	6802.3	O K
120 min Summer	0.642	0.642	61.8	8276.8	O K
180 min Summer	0.706	0.706	61.8	9129.6	Flood Risk
240 min Summer	0.747	0.747	61.8	9676.5	Flood Risk
360 min Summer	0.792	0.792	61.8	10281.8	Flood Risk
480 min Summer	0.812	0.812	61.8	10549.8	Flood Risk
600 min Summer	0.820	0.820	61.8	10650.0	Flood Risk
720 min Summer	0.820	0.820	61.8	10654.5	Flood Risk
960 min Summer	0.808	0.808	61.8	10496.1	Flood Risk
1440 min Summer	0.765	0.765	61.8	9917.3	Flood Risk
2160 min Summer	0.714	0.714	61.8	9225.7	Flood Risk
2880 min Summer	0.674	0.674	61.8	8696.6	O K
4320 min Summer	0.615	0.615	61.8	7909.5	O K
5760 min Summer	0.568	0.568	61.8	7293.0	O K
7200 min Summer	0.531	0.531	61.8	6802.2	O K
8640 min Summer	0.501	0.501	61.8	6409.7	O K
10080 min Summer	0.477	0.477	61.8	6100.5	O K
15 min Winter	0.384	0.384	61.1	4889.3	O K
30 min Winter	0.491	0.491	61.8	6284.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	2889.1	23	
30 min Summer	98.091	0.0	3818.1	38	
60 min Summer	59.966	0.0	5866.2	68	
120 min Summer	36.932	0.0	7233.2	126	
180 min Summer	27.466	0.0	8004.6	186	
240 min Summer	22.073	0.0	8485.0	246	
360 min Summer	15.975	0.0	8992.7	366	
480 min Summer	12.562	0.0	9200.3	484	
600 min Summer	10.371	0.0	9266.0	604	
720 min Summer	8.843	0.0	9249.3	724	
960 min Summer	6.842	0.0	9071.3	962	
1440 min Summer	4.743	0.0	8524.3	1286	
2160 min Summer	3.288	0.0	12736.6	1600	
2880 min Summer	2.547	0.0	13039.7	1968	
4320 min Summer	1.811	0.0	13479.6	2768	
5760 min Summer	1.443	0.0	15644.6	3576	
7200 min Summer	1.224	0.0	16537.4	4328	
8640 min Summer	1.080	0.0	17413.7	5104	
10080 min Summer	0.980	0.0	18225.7	5856	
15 min Winter	152.119	0.0	3291.2	23	
30 min Winter	98.091	0.0	4259.6	37	
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XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.594	0.594	61.8	7632.3	O K
120 min Winter	0.719	0.719	61.8	9296.2	Flood Risk
180 min Winter	0.791	0.791	61.8	10267.0	Flood Risk
240 min Winter	0.838	0.838	61.8	10892.6	Flood Risk
360 min Winter	0.889	0.889	61.8	11585.3	Flood Risk
480 min Winter	0.912	0.912	61.8	11896.7	Flood Risk
600 min Winter	0.921	0.921	61.8	12023.7	Flood Risk
720 min Winter	0.923	0.923	61.8	12047.0	Flood Risk
960 min Winter	0.913	0.913	61.8	11915.6	Flood Risk
1440 min Winter	0.874	0.874	61.8	11388.6	Flood Risk
2160 min Winter	0.807	0.807	61.8	10477.1	Flood Risk
2880 min Winter	0.751	0.751	61.8	9732.0	Flood Risk
4320 min Winter	0.661	0.661	61.8	8528.7	O K
5760 min Winter	0.587	0.587	61.8	7543.0	O K
7200 min Winter	0.526	0.526	61.8	6738.2	O K
8640 min Winter	0.476	0.476	61.8	6088.5	O K
10080 min Winter	0.437	0.437	61.7	5573.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	6593.1	66	
120 min Winter	36.932	0.0	8054.1	124	
180 min Winter	27.466	0.0	8824.2	184	
240 min Winter	22.073	0.0	9254.2	242	
360 min Winter	15.975	0.0	9620.5	360	
480 min Winter	12.562	0.0	9672.2	476	
600 min Winter	10.371	0.0	9585.9	592	
720 min Winter	8.843	0.0	9451.9	708	
960 min Winter	6.842	0.0	9167.6	936	
1440 min Winter	4.743	0.0	8578.7	1372	
2160 min Winter	3.288	0.0	14200.9	1752	
2880 min Winter	2.547	0.0	14519.6	2164	
4320 min Winter	1.811	0.0	14903.7	3028	
5760 min Winter	1.443	0.0	17551.4	3864	
7200 min Winter	1.224	0.0	18565.0	4616	
8640 min Winter	1.080	0.0	19565.0	5368	
10080 min Winter	0.980	0.0	20505.6	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 15.440

Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)
0	4 7.720	4	8 7.720

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		Micro Drainage																																																																																																			
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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0322-6180-1000-6180 Design Head (m) 1.000 Design Flow (l/s) 61.8 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 322 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 375 Suggested Manhole Diameter (mm) 2100 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>61.7</td></tr><tr><td>Flush-Flo™</td><td>0.475</td><td>61.8</td></tr><tr><td>Kick-Flo®</td><td>0.802</td><td>55.5</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>48.9</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>9.6</td><td>1.200</td><td>67.4</td><td>3.000</td><td>105.2</td><td>7.000</td><td>159.1</td></tr><tr><td>0.200</td><td>32.9</td><td>1.400</td><td>72.6</td><td>3.500</td><td>113.4</td><td>7.500</td><td>164.6</td></tr><tr><td>0.300</td><td>58.0</td><td>1.600</td><td>77.5</td><td>4.000</td><td>121.0</td><td>8.000</td><td>169.8</td></tr><tr><td>0.400</td><td>61.3</td><td>1.800</td><td>82.0</td><td>4.500</td><td>128.2</td><td>8.500</td><td>175.0</td></tr><tr><td>0.500</td><td>61.7</td><td>2.000</td><td>86.3</td><td>5.000</td><td>134.9</td><td>9.000</td><td>179.9</td></tr><tr><td>0.600</td><td>60.9</td><td>2.200</td><td>90.4</td><td>5.500</td><td>141.4</td><td>9.500</td><td>184.8</td></tr><tr><td>0.800</td><td>55.6</td><td>2.400</td><td>94.3</td><td>6.000</td><td>147.5</td><td></td><td></td></tr><tr><td>1.000</td><td>61.7</td><td>2.600</td><td>98.1</td><td>6.500</td><td>153.4</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	61.7	Flush-Flo™	0.475	61.8	Kick-Flo®	0.802	55.5	Mean Flow over Head Range	-	48.9	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	9.6	1.200	67.4	3.000	105.2	7.000	159.1	0.200	32.9	1.400	72.6	3.500	113.4	7.500	164.6	0.300	58.0	1.600	77.5	4.000	121.0	8.000	169.8	0.400	61.3	1.800	82.0	4.500	128.2	8.500	175.0	0.500	61.7	2.000	86.3	5.000	134.9	9.000	179.9	0.600	60.9	2.200	90.4	5.500	141.4	9.500	184.8	0.800	55.6	2.400	94.3	6.000	147.5			1.000	61.7	2.600	98.1	6.500	153.4		
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240 min Summer	22.073	0.0	2847.0	246																																																																																																																																						
360 min Summer	15.975	0.0	3064.3	366																																																																																																																																						
480 min Summer	12.562	0.0	3174.3	484																																																																																																																																						
600 min Summer	10.371	0.0	3232.6	604																																																																																																																																						
720 min Summer	8.843	0.0	3261.1	722																																																																																																																																						
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2160 min Summer	3.288	0.0	4565.1	1564																																																																																																																																						
2880 min Summer	2.547	0.0	4639.1	1960																																																																																																																																						
4320 min Summer	1.811	0.0	4703.5	2768																																																																																																																																						
5760 min Summer	1.443	0.0	5900.6	3568																																																																																																																																						
7200 min Summer	1.224	0.0	6209.8	4328																																																																																																																																						
8640 min Summer	1.080	0.0	6498.1	5104																																																																																																																																						
10080 min Summer	0.980	0.0	6740.6	5856																																																																																																																																						
15 min Winter	152.119	0.0	841.6	23																																																																																																																																						
30 min Winter	98.091	0.0	1191.7	37																																																																																																																																						
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XP Solutions			Source Control 2019.1		
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.239	0.239	24.0	3025.9	O K
120 min Winter	0.291	0.291	24.4	3687.5	O K
180 min Winter	0.321	0.321	24.4	4073.7	O K
240 min Winter	0.340	0.340	24.4	4323.9	O K
360 min Winter	0.362	0.362	24.4	4607.5	O K
480 min Winter	0.373	0.373	24.4	4741.8	O K
600 min Winter	0.377	0.377	24.4	4803.0	O K
720 min Winter	0.379	0.379	24.4	4822.9	O K
960 min Winter	0.376	0.376	24.4	4789.9	O K
1440 min Winter	0.363	0.363	24.4	4612.4	O K
2160 min Winter	0.341	0.341	24.4	4328.3	O K
2880 min Winter	0.325	0.325	24.4	4119.6	O K
4320 min Winter	0.299	0.299	24.4	3788.5	O K
5760 min Winter	0.278	0.278	24.3	3519.3	O K
7200 min Winter	0.261	0.261	24.2	3299.0	O K
8640 min Winter	0.247	0.247	24.1	3120.5	O K
10080 min Winter	0.236	0.236	24.0	2978.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2126.5	66	
120 min Winter	36.932	0.0	2679.6	124	
180 min Winter	27.466	0.0	2989.9	184	
240 min Winter	22.073	0.0	3184.2	242	
360 min Winter	15.975	0.0	3396.3	360	
480 min Winter	12.562	0.0	3492.9	476	
600 min Winter	10.371	0.0	3535.0	592	
720 min Winter	8.843	0.0	3546.2	708	
960 min Winter	6.842	0.0	3514.8	934	
1440 min Winter	4.743	0.0	3342.5	1368	
2160 min Winter	3.288	0.0	5123.0	1688	
2880 min Winter	2.547	0.0	5198.9	2136	
4320 min Winter	1.811	0.0	5245.9	3024	
5760 min Winter	1.443	0.0	6643.6	3856	
7200 min Winter	1.224	0.0	6997.6	4616	
8640 min Winter	1.080	0.0	7330.0	5440	
10080 min Winter	0.980	0.0	7614.5	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.100

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	3.050	4 8	3.050

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0223-2440-0500-2440
Design Head (m)	0.500
Design Flow (l/s)	24.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	223
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	24.4
Flush-Flo™	0.304	24.4
Kick-Flo®	0.441	23.0
Mean Flow over Head Range	-	17.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.5	1.200	37.1	3.000	57.8	7.000	87.0
0.200	22.1	1.400	40.0	3.500	62.3	7.500	90.1
0.300	24.4	1.600	42.6	4.000	66.5	8.000	93.1
0.400	23.7	1.800	45.1	4.500	70.4	8.500	96.0
0.500	24.4	2.000	47.5	5.000	74.1	9.000	98.8
0.600	26.6	2.200	49.7	5.500	76.9	9.500	101.6
0.800	30.5	2.400	51.9	6.000	80.4		
1.000	34.0	2.600	53.9	6.500	83.8		

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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status																																																																																																																																					
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.111	0.111	6.8	1398.6	O K
120 min Winter	0.136	0.136	8.9	1708.0	O K
180 min Winter	0.150	0.150	10.0	1889.0	O K
240 min Winter	0.159	0.159	10.7	2006.6	O K
360 min Winter	0.170	0.170	10.9	2142.1	O K
480 min Winter	0.175	0.175	11.0	2210.0	O K
600 min Winter	0.178	0.178	11.0	2244.6	O K
720 min Winter	0.179	0.179	11.0	2260.4	O K
960 min Winter	0.179	0.179	11.0	2259.2	O K
1440 min Winter	0.175	0.175	11.0	2206.5	O K
2160 min Winter	0.168	0.168	10.9	2116.5	O K
2880 min Winter	0.164	0.164	10.9	2060.8	O K
4320 min Winter	0.158	0.158	10.6	1985.5	O K
5760 min Winter	0.153	0.153	10.3	1928.9	O K
7200 min Winter	0.150	0.150	10.0	1885.3	O K
8640 min Winter	0.147	0.147	9.8	1850.8	O K
10080 min Winter	0.145	0.145	9.7	1825.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	681.2	66	
120 min Winter	36.932	0.0	900.0	126	
180 min Winter	27.466	0.0	1031.7	184	
240 min Winter	22.073	0.0	1119.0	242	
360 min Winter	15.975	0.0	1221.3	360	
480 min Winter	12.562	0.0	1273.2	476	
600 min Winter	10.371	0.0	1300.9	592	
720 min Winter	8.843	0.0	1314.8	708	
960 min Winter	6.842	0.0	1318.0	934	
1440 min Winter	4.743	0.0	1278.2	1370	
2160 min Winter	3.288	0.0	1992.7	1704	
2880 min Winter	2.547	0.0	2002.4	2140	
4320 min Winter	1.811	0.0	1965.1	3032	
5760 min Winter	1.443	0.0	2780.9	3920	
7200 min Winter	1.224	0.0	2905.9	4752	
8640 min Winter	1.080	0.0	3012.4	5544	
10080 min Winter	0.980	0.0	3087.1	6360	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.800

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 1.400	4	8 1.400

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0159-1120-0500-1120
Design Head (m)	0.500
Design Flow (l/s)	11.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	159
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	11.2
Flush-Flo™	0.235	11.2
Kick-Flo®	0.401	10.1
Mean Flow over Head Range	-	8.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.7	1.200	16.9	3.000	26.3	7.000	39.6
0.200	11.1	1.400	18.2	3.500	28.3	7.500	41.0
0.300	11.0	1.600	19.4	4.000	30.2	8.000	42.3
0.400	10.1	1.800	20.6	4.500	32.0	8.500	43.7
0.500	11.2	2.000	21.6	5.000	33.6	9.000	44.9
0.600	12.2	2.200	22.6	5.500	35.0	9.500	46.2
0.800	14.0	2.400	23.6	6.000	36.6		
1.000	15.5	2.600	24.5	6.500	38.1		

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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.168	0.168	12.3	2118.3	O K
120 min Winter	0.205	0.205	12.7	2588.4	O K
180 min Winter	0.227	0.227	12.8	2866.8	O K
240 min Winter	0.241	0.241	12.8	3050.4	O K
360 min Winter	0.258	0.258	12.8	3266.9	O K
480 min Winter	0.267	0.267	12.8	3379.2	O K
600 min Winter	0.272	0.272	12.8	3440.6	O K
720 min Winter	0.274	0.274	12.8	3472.8	O K
960 min Winter	0.275	0.275	12.8	3486.3	O K
1440 min Winter	0.271	0.271	12.8	3432.2	O K
2160 min Winter	0.260	0.260	12.8	3288.5	O K
2880 min Winter	0.250	0.250	12.8	3167.4	O K
4320 min Winter	0.239	0.239	12.8	3026.8	O K
5760 min Winter	0.231	0.231	12.8	2914.5	O K
7200 min Winter	0.223	0.223	12.8	2822.3	O K
8640 min Winter	0.217	0.217	12.8	2746.7	O K
10080 min Winter	0.213	0.213	12.7	2686.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	1219.7	66	
120 min Winter	36.932	0.0	1548.9	126	
180 min Winter	27.466	0.0	1721.5	184	
240 min Winter	22.073	0.0	1821.6	242	
360 min Winter	15.975	0.0	1916.6	360	
480 min Winter	12.562	0.0	1946.9	478	
600 min Winter	10.371	0.0	1948.5	596	
720 min Winter	8.843	0.0	1935.3	712	
960 min Winter	6.842	0.0	1885.4	942	
1440 min Winter	4.743	0.0	1748.3	1396	
2160 min Winter	3.288	0.0	3134.2	2028	
2880 min Winter	2.547	0.0	3124.8	2276	
4320 min Winter	1.811	0.0	2993.6	3160	
5760 min Winter	1.443	0.0	4388.0	4040	
7200 min Winter	1.224	0.0	4595.2	4904	
8640 min Winter	1.080	0.0	4775.9	5784	
10080 min Winter	0.980	0.0	4904.9	6560	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.250

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	2.125	4 8	2.125

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<u>Model Details</u> Storage is Online Cover Level (m) 1.000 <u>Tank or Pond Structure</u> Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> <u>Hydro-Brake® Optimum Outflow Control</u> <table><tr><td>Unit Reference</td><td>MD-SHE-0169-1280-0500-1280</td></tr><tr><td>Design Head (m)</td><td>0.500</td></tr><tr><td>Design Flow (l/s)</td><td>12.8</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Application</td><td>Surface</td></tr><tr><td>Sump Available</td><td>Yes</td></tr><tr><td>Diameter (mm)</td><td>169</td></tr><tr><td>Invert Level (m)</td><td>0.000</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>225</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>1200</td></tr></table> <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>12.8</td></tr><tr><td>Flush-Flo™</td><td>0.245</td><td>12.8</td></tr><tr><td>Kick-Flo®</td><td>0.407</td><td>11.6</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>10.0</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>6.0</td><td>1.200</td><td>19.4</td><td>3.000</td><td>30.1</td><td>7.000</td><td>45.3</td></tr><tr><td>0.200</td><td>12.7</td><td>1.400</td><td>20.9</td><td>3.500</td><td>32.4</td><td>7.500</td><td>46.9</td></tr><tr><td>0.300</td><td>12.7</td><td>1.600</td><td>22.2</td><td>4.000</td><td>34.6</td><td>8.000</td><td>48.5</td></tr><tr><td>0.400</td><td>11.8</td><td>1.800</td><td>23.5</td><td>4.500</td><td>36.6</td><td>8.500</td><td>50.0</td></tr><tr><td>0.500</td><td>12.8</td><td>2.000</td><td>24.8</td><td>5.000</td><td>38.5</td><td>9.000</td><td>51.4</td></tr><tr><td>0.600</td><td>14.0</td><td>2.200</td><td>25.9</td><td>5.500</td><td>40.1</td><td>9.500</td><td>52.9</td></tr><tr><td>0.800</td><td>16.0</td><td>2.400</td><td>27.0</td><td>6.000</td><td>41.9</td><td></td><td></td></tr><tr><td>1.000</td><td>17.8</td><td>2.600</td><td>28.1</td><td>6.500</td><td>43.6</td><td></td><td></td></tr></table>				Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3	Unit Reference	MD-SHE-0169-1280-0500-1280	Design Head (m)	0.500	Design Flow (l/s)	12.8	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	169	Invert Level (m)	0.000	Minimum Outlet Pipe Diameter (mm)	225	Suggested Manhole Diameter (mm)	1200	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	12.8	Flush-Flo™	0.245	12.8	Kick-Flo®	0.407	11.6	Mean Flow over Head Range	-	10.0	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.0	1.200	19.4	3.000	30.1	7.000	45.3	0.200	12.7	1.400	20.9	3.500	32.4	7.500	46.9	0.300	12.7	1.600	22.2	4.000	34.6	8.000	48.5	0.400	11.8	1.800	23.5	4.500	36.6	8.500	50.0	0.500	12.8	2.000	24.8	5.000	38.5	9.000	51.4	0.600	14.0	2.200	25.9	5.500	40.1	9.500	52.9	0.800	16.0	2.400	27.0	6.000	41.9			1.000	17.8	2.600	28.1	6.500	43.6		
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<table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>0.134</td><td>0.134</td><td>12.3</td><td>1689.8</td><td>O K</td></tr><tr><td>30 min Summer</td><td>0.172</td><td>0.172</td><td>18.0</td><td>2170.7</td><td>O K</td></tr><tr><td>60 min Summer</td><td>0.209</td><td>0.209</td><td>22.8</td><td>2633.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>0.253</td><td>0.253</td><td>23.6</td><td>3204.8</td><td>O K</td></tr><tr><td>180 min Summer</td><td>0.279</td><td>0.279</td><td>23.8</td><td>3537.1</td><td>O K</td></tr><tr><td>240 min Summer</td><td>0.296</td><td>0.296</td><td>23.8</td><td>3751.1</td><td>O K</td></tr><tr><td>360 min Summer</td><td>0.314</td><td>0.314</td><td>23.8</td><td>3989.9</td><td>O K</td></tr><tr><td>480 min Summer</td><td>0.323</td><td>0.323</td><td>23.8</td><td>4099.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>0.326</td><td>0.326</td><td>23.8</td><td>4144.3</td><td>O K</td></tr><tr><td>720 min Summer</td><td>0.327</td><td>0.327</td><td>23.8</td><td>4152.9</td><td>O K</td></tr><tr><td>960 min Summer</td><td>0.323</td><td>0.323</td><td>23.8</td><td>4105.5</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>0.311</td><td>0.311</td><td>23.8</td><td>3940.3</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>0.297</td><td>0.297</td><td>23.8</td><td>3760.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>0.286</td><td>0.286</td><td>23.8</td><td>3627.2</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>0.272</td><td>0.272</td><td>23.7</td><td>3440.7</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>0.261</td><td>0.261</td><td>23.7</td><td>3297.3</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>0.252</td><td>0.252</td><td>23.6</td><td>3184.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>0.245</td><td>0.245</td><td>23.5</td><td>3094.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>0.239</td><td>0.239</td><td>23.5</td><td>3024.5</td><td>O K</td></tr><tr><td>15 min Winter</td><td>0.150</td><td>0.150</td><td>14.7</td><td>1892.0</td><td>O K</td></tr><tr><td>30 min Winter</td><td>0.193</td><td>0.193</td><td>20.8</td><td>2430.8</td><td>O K</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	0.134	0.134	12.3	1689.8	O K	30 min Summer	0.172	0.172	18.0	2170.7	O K	60 min Summer	0.209	0.209	22.8	2633.9	O K	120 min Summer	0.253	0.253	23.6	3204.8	O K	180 min Summer	0.279	0.279	23.8	3537.1	O K	240 min Summer	0.296	0.296	23.8	3751.1	O K	360 min Summer	0.314	0.314	23.8	3989.9	O K	480 min Summer	0.323	0.323	23.8	4099.2	O K	600 min Summer	0.326	0.326	23.8	4144.3	O K	720 min Summer	0.327	0.327	23.8	4152.9	O K	960 min Summer	0.323	0.323	23.8	4105.5	O K	1440 min Summer	0.311	0.311	23.8	3940.3	O K	2160 min Summer	0.297	0.297	23.8	3760.5	O K	2880 min Summer	0.286	0.286	23.8	3627.2	O K	4320 min Summer	0.272	0.272	23.7	3440.7	O K	5760 min Summer	0.261	0.261	23.7	3297.3	O K	7200 min Summer	0.252	0.252	23.6	3184.1	O K	8640 min Summer	0.245	0.245	23.5	3094.0	O K	10080 min Summer	0.239	0.239	23.5	3024.5	O K	15 min Winter	0.150	0.150	14.7	1892.0	O K	30 min Winter	0.193	0.193	20.8	2430.8	O K
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.234	0.234	23.4	2952.0	O K
120 min Winter	0.284	0.284	23.8	3597.4	O K
180 min Winter	0.313	0.313	23.8	3974.3	O K
240 min Winter	0.332	0.332	23.8	4218.5	O K
360 min Winter	0.354	0.354	23.8	4495.3	O K
480 min Winter	0.364	0.364	23.8	4626.7	O K
600 min Winter	0.368	0.368	23.8	4686.7	O K
720 min Winter	0.370	0.370	23.8	4706.2	O K
960 min Winter	0.368	0.368	23.8	4674.8	O K
1440 min Winter	0.354	0.354	23.8	4503.0	O K
2160 min Winter	0.333	0.333	23.8	4228.8	O K
2880 min Winter	0.317	0.317	23.8	4027.6	O K
4320 min Winter	0.293	0.293	23.8	3708.8	O K
5760 min Winter	0.272	0.272	23.7	3450.0	O K
7200 min Winter	0.256	0.256	23.6	3238.2	O K
8640 min Winter	0.243	0.243	23.5	3066.6	O K
10080 min Winter	0.232	0.232	23.4	2929.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	2057.1	66	
120 min Winter	36.932	0.0	2595.6	124	
180 min Winter	27.466	0.0	2898.2	184	
240 min Winter	22.073	0.0	3087.9	242	
360 min Winter	15.975	0.0	3295.5	360	
480 min Winter	12.562	0.0	3390.8	476	
600 min Winter	10.371	0.0	3432.9	592	
720 min Winter	8.843	0.0	3445.1	708	
960 min Winter	6.842	0.0	3416.5	934	
1440 min Winter	4.743	0.0	3252.6	1368	
2160 min Winter	3.288	0.0	4978.6	1688	
2880 min Winter	2.547	0.0	5051.3	2136	
4320 min Winter	1.811	0.0	5094.1	3024	
5760 min Winter	1.443	0.0	6468.1	3856	
7200 min Winter	1.224	0.0	6811.6	4616	
8640 min Winter	1.080	0.0	7133.4	5440	
10080 min Winter	0.980	0.0	7407.7	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.950

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 2.975	4	8 2.975

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0220-2380-0500-2380
Design Head (m)	0.500
Design Flow (l/s)	23.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	220
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	23.8
Flush-Flo™	0.301	23.8
Kick-Flo®	0.440	22.4
Mean Flow over Head Range	-	17.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.4	1.200	36.2	3.000	56.3	7.000	84.8
0.200	21.8	1.400	39.0	3.500	60.7	7.500	87.8
0.300	23.8	1.600	41.6	4.000	64.8	8.000	90.7
0.400	23.1	1.800	44.0	4.500	68.6	8.500	93.6
0.500	23.8	2.000	46.3	5.000	72.2	9.000	96.3
0.600	25.9	2.200	48.5	5.500	75.0	9.500	99.0
0.800	29.8	2.400	50.5	6.000	78.4		
1.000	33.1	2.600	52.5	6.500	81.6		

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.400

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	1.700	4 8	1.700

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0173-1360-0500-1360
Design Head (m)	0.500
Design Flow (l/s)	13.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	173
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	13.6
Flush-Flo™	0.251	13.6
Kick-Flo®	0.410	12.4
Mean Flow over Head Range	-	10.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	20.6	3.000	32.0	7.000	48.2
0.200	13.4	1.400	22.2	3.500	34.5	7.500	49.9
0.300	13.4	1.600	23.6	4.000	36.8	8.000	51.5
0.400	12.5	1.800	25.0	4.500	38.9	8.500	53.1
0.500	13.6	2.000	26.3	5.000	41.0	9.000	54.7
0.600	14.8	2.200	27.5	5.500	42.6	9.500	56.2
0.800	17.0	2.400	28.7	6.000	44.5		
1.000	18.9	2.600	29.9	6.500	46.4		

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Summary of Results for 100 year Return Period (+40%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
15 min Summer	0.073	0.073	3.5	910.7	O K	
30 min Summer	0.093	0.093	5.3	1171.9	O K	
60 min Summer	0.113	0.113	7.3	1426.3	O K	
120 min Summer	0.138	0.138	9.8	1739.6	O K	
180 min Summer	0.153	0.153	11.1	1921.9	O K	
240 min Summer	0.162	0.162	11.8	2039.4	O K	
360 min Summer	0.172	0.172	12.5	2171.8	O K	
480 min Summer	0.177	0.177	12.5	2235.2	O K	
600 min Summer	0.180	0.180	12.5	2264.7	O K	
720 min Summer	0.180	0.180	12.5	2274.9	O K	
960 min Summer	0.179	0.179	12.5	2261.3	O K	
1440 min Summer	0.174	0.174	12.5	2193.5	O K	
2160 min Summer	0.169	0.169	12.3	2127.1	O K	
2880 min Summer	0.166	0.166	12.1	2085.1	O K	
4320 min Summer	0.162	0.162	11.8	2037.3	O K	
5760 min Summer	0.159	0.159	11.6	2006.7	O K	
7200 min Summer	0.158	0.158	11.5	1985.8	O K	
8640 min Summer	0.157	0.157	11.4	1972.2	O K	
10080 min Summer	0.156	0.156	11.3	1964.1	O K	
15 min Winter	0.081	0.081	4.2	1019.8	O K	
30 min Winter	0.104	0.104	6.4	1312.1	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	152.119	0.0	228.4	23		
30 min Summer	98.091	0.0	341.6	38		
60 min Summer	59.966	0.0	718.0	68		
120 min Summer	36.932	0.0	949.0	128		
180 min Summer	27.466	0.0	1089.2	186		
240 min Summer	22.073	0.0	1182.8	246		
360 min Summer	15.975	0.0	1294.6	366		
480 min Summer	12.562	0.0	1353.5	484		
600 min Summer	10.371	0.0	1386.2	604		
720 min Summer	8.843	0.0	1404.0	722		
960 min Summer	6.842	0.0	1412.9	962		
1440 min Summer	4.743	0.0	1380.3	1242		
2160 min Summer	3.288	0.0	2083.5	1584		
2880 min Summer	2.547	0.0	2097.0	1988		
4320 min Summer	1.811	0.0	2071.6	2808		
5760 min Summer	1.443	0.0	2867.5	3624		
7200 min Summer	1.224	0.0	2999.6	4400		
8640 min Summer	1.080	0.0	3114.0	5192		
10080 min Summer	0.980	0.0	3197.3	5960		
15 min Winter	152.119	0.0	274.5	23		
30 min Winter	98.091	0.0	406.8	37		
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.127	0.127	8.7	1596.7	O K
120 min Winter	0.155	0.155	11.3	1948.0	O K
180 min Winter	0.171	0.171	12.4	2152.8	O K
240 min Winter	0.181	0.181	12.5	2286.3	O K
360 min Winter	0.193	0.193	12.6	2440.4	O K
480 min Winter	0.199	0.199	12.7	2516.6	O K
600 min Winter	0.202	0.202	12.7	2554.6	O K
720 min Winter	0.204	0.204	12.7	2570.9	O K
960 min Winter	0.203	0.203	12.7	2565.9	O K
1440 min Winter	0.198	0.198	12.7	2498.7	O K
2160 min Winter	0.189	0.189	12.6	2387.3	O K
2880 min Winter	0.183	0.183	12.6	2313.8	O K
4320 min Winter	0.175	0.175	12.5	2207.0	O K
5760 min Winter	0.169	0.169	12.3	2128.2	O K
7200 min Winter	0.164	0.164	12.0	2069.2	O K
8640 min Winter	0.161	0.161	11.7	2022.8	O K
10080 min Winter	0.158	0.158	11.5	1986.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	839.8	66	
120 min Winter	36.932	0.0	1101.4	126	
180 min Winter	27.466	0.0	1257.9	184	
240 min Winter	22.073	0.0	1360.0	242	
360 min Winter	15.975	0.0	1476.6	360	
480 min Winter	12.562	0.0	1535.3	476	
600 min Winter	10.371	0.0	1566.1	592	
720 min Winter	8.843	0.0	1581.2	708	
960 min Winter	6.842	0.0	1583.0	934	
1440 min Winter	4.743	0.0	1533.1	1368	
2160 min Winter	3.288	0.0	2364.0	1692	
2880 min Winter	2.547	0.0	2381.9	2136	
4320 min Winter	1.811	0.0	2356.4	3028	
5760 min Winter	1.443	0.0	3249.1	3864	
7200 min Winter	1.224	0.0	3400.6	4688	
8640 min Winter	1.080	0.0	3532.7	5528	
10080 min Winter	0.980	0.0	3630.0	6344	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.200

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	1.600	4 8	1.600

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		Micro Drainage																																																																																																			
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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0169-1280-0500-1280 Design Head (m) 0.500 Design Flow (l/s) 12.8 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 169 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><td></td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>12.8</td></tr><tr><td>Flush-Flo™</td><td>0.245</td><td>12.8</td></tr><tr><td>Kick-Flo®</td><td>0.407</td><td>11.6</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>10.0</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>6.0</td><td>1.200</td><td>19.4</td><td>3.000</td><td>30.1</td><td>7.000</td><td>45.3</td></tr><tr><td>0.200</td><td>12.7</td><td>1.400</td><td>20.9</td><td>3.500</td><td>32.4</td><td>7.500</td><td>46.9</td></tr><tr><td>0.300</td><td>12.7</td><td>1.600</td><td>22.2</td><td>4.000</td><td>34.6</td><td>8.000</td><td>48.5</td></tr><tr><td>0.400</td><td>11.8</td><td>1.800</td><td>23.5</td><td>4.500</td><td>36.6</td><td>8.500</td><td>50.0</td></tr><tr><td>0.500</td><td>12.8</td><td>2.000</td><td>24.8</td><td>5.000</td><td>38.5</td><td>9.000</td><td>51.4</td></tr><tr><td>0.600</td><td>14.0</td><td>2.200</td><td>25.9</td><td>5.500</td><td>40.1</td><td>9.500</td><td>52.9</td></tr><tr><td>0.800</td><td>16.0</td><td>2.400</td><td>27.0</td><td>6.000</td><td>41.9</td><td></td><td></td></tr><tr><td>1.000</td><td>17.8</td><td>2.600</td><td>28.1</td><td>6.500</td><td>43.6</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3		Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	12.8	Flush-Flo™	0.245	12.8	Kick-Flo®	0.407	11.6	Mean Flow over Head Range	-	10.0	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.0	1.200	19.4	3.000	30.1	7.000	45.3	0.200	12.7	1.400	20.9	3.500	32.4	7.500	46.9	0.300	12.7	1.600	22.2	4.000	34.6	8.000	48.5	0.400	11.8	1.800	23.5	4.500	36.6	8.500	50.0	0.500	12.8	2.000	24.8	5.000	38.5	9.000	51.4	0.600	14.0	2.200	25.9	5.500	40.1	9.500	52.9	0.800	16.0	2.400	27.0	6.000	41.9			1.000	17.8	2.600	28.1	6.500	43.6		
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.178	0.178	16.2	2247.9	O K
120 min Winter	0.217	0.217	17.8	2738.8	O K
180 min Winter	0.239	0.239	18.0	3026.6	O K
240 min Winter	0.254	0.254	18.0	3213.5	O K
360 min Winter	0.271	0.271	18.1	3426.7	O K
480 min Winter	0.279	0.279	18.1	3529.3	O K
600 min Winter	0.282	0.282	18.1	3577.8	O K
720 min Winter	0.284	0.284	18.1	3595.6	O K
960 min Winter	0.282	0.282	18.1	3578.1	O K
1440 min Winter	0.273	0.273	18.1	3461.4	O K
2160 min Winter	0.259	0.259	18.1	3275.9	O K
2880 min Winter	0.249	0.249	18.0	3143.6	O K
4320 min Winter	0.233	0.233	17.9	2939.1	O K
5760 min Winter	0.220	0.220	17.9	2775.5	O K
7200 min Winter	0.209	0.209	17.7	2643.5	O K
8640 min Winter	0.201	0.201	17.7	2538.5	O K
10080 min Winter	0.195	0.195	17.6	2457.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	1404.5	66	
120 min Winter	36.932	0.0	1805.2	124	
180 min Winter	27.466	0.0	2032.7	184	
240 min Winter	22.073	0.0	2177.4	242	
360 min Winter	15.975	0.0	2339.8	360	
480 min Winter	12.562	0.0	2418.6	476	
600 min Winter	10.371	0.0	2457.4	592	
720 min Winter	8.843	0.0	2473.6	708	
960 min Winter	6.842	0.0	2465.8	934	
1440 min Winter	4.743	0.0	2370.9	1368	
2160 min Winter	3.288	0.0	3609.1	1688	
2880 min Winter	2.547	0.0	3651.3	2136	
4320 min Winter	1.811	0.0	3658.2	3024	
5760 min Winter	1.443	0.0	4794.2	3864	
7200 min Winter	1.224	0.0	5037.5	4680	
8640 min Winter	1.080	0.0	5259.5	5448	
10080 min Winter	0.980	0.0	5439.4	6160	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.520

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 2.260	4	8 2.260

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0196-1810-0500-1810
Design Head (m)	0.500
Design Flow (l/s)	18.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	196
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	18.1
Flush-Flo™	0.275	18.1
Kick-Flo®	0.424	16.7
Mean Flow over Head Range	-	13.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	27.5	3.000	42.7	7.000	64.3
0.200	17.6	1.400	29.6	3.500	46.0	7.500	66.6
0.300	18.0	1.600	31.5	4.000	49.1	8.000	68.8
0.400	17.2	1.800	33.4	4.500	52.0	8.500	71.0
0.500	18.1	2.000	35.1	5.000	54.7	9.000	73.0
0.600	19.7	2.200	36.8	5.500	56.9	9.500	75.1
0.800	22.6	2.400	38.3	6.000	59.5		
1.000	25.2	2.600	39.9	6.500	61.9		

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<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
15 min Summer	0.084	0.084	4.7	1049.8	O K	
30 min Summer	0.107	0.107	7.1	1350.4	O K	
60 min Summer	0.131	0.131	9.7	1642.4	O K	
120 min Summer	0.159	0.159	12.6	2001.1	O K	
180 min Summer	0.175	0.175	14.1	2208.6	O K	
240 min Summer	0.186	0.186	14.4	2342.1	O K	
360 min Summer	0.198	0.198	14.5	2493.6	O K	
480 min Summer	0.203	0.203	14.6	2565.5	O K	
600 min Summer	0.206	0.206	14.6	2598.0	O K	
720 min Summer	0.207	0.207	14.6	2607.9	O K	
960 min Summer	0.205	0.205	14.6	2588.3	O K	
1440 min Summer	0.198	0.198	14.6	2503.7	O K	
2160 min Summer	0.192	0.192	14.5	2417.0	O K	
2880 min Summer	0.187	0.187	14.4	2358.4	O K	
4320 min Summer	0.181	0.181	14.4	2287.1	O K	
5760 min Summer	0.178	0.178	14.3	2239.2	O K	
7200 min Summer	0.175	0.175	14.0	2205.2	O K	
8640 min Summer	0.173	0.173	13.9	2180.6	O K	
10080 min Summer	0.172	0.172	13.8	2164.2	O K	
15 min Winter	0.094	0.094	5.7	1175.5	O K	
30 min Winter	0.120	0.120	8.6	1511.9	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	152.119	0.0	297.2	23		
30 min Summer	98.091	0.0	440.3	38		
60 min Summer	59.966	0.0	896.2	68		
120 min Summer	36.932	0.0	1175.8	126		
180 min Summer	27.466	0.0	1344.5	186		
240 min Summer	22.073	0.0	1456.3	246		
360 min Summer	15.975	0.0	1586.8	366		
480 min Summer	12.562	0.0	1654.7	484		
600 min Summer	10.371	0.0	1692.3	604		
720 min Summer	8.843	0.0	1712.6	722		
960 min Summer	6.842	0.0	1722.0	962		
1440 min Summer	4.743	0.0	1681.7	1238		
2160 min Summer	3.288	0.0	2499.0	1580		
2880 min Summer	2.547	0.0	2524.1	1964		
4320 min Summer	1.811	0.0	2512.0	2768		
5760 min Summer	1.443	0.0	3380.7	3576		
7200 min Summer	1.224	0.0	3541.9	4392		
8640 min Summer	1.080	0.0	3684.7	5184		
10080 min Summer	0.980	0.0	3793.1	5944		
15 min Winter	152.119	0.0	355.6	23		
30 min Winter	98.091	0.0	522.0	37		
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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.146	0.146	11.4	1838.8	O K
120 min Winter	0.178	0.178	14.3	2241.2	O K
180 min Winter	0.196	0.196	14.5	2476.5	O K
240 min Winter	0.208	0.208	14.6	2630.1	O K
360 min Winter	0.222	0.222	14.7	2806.2	O K
480 min Winter	0.229	0.229	14.7	2892.2	O K
600 min Winter	0.232	0.232	14.8	2933.9	O K
720 min Winter	0.233	0.233	14.8	2950.8	O K
960 min Winter	0.233	0.233	14.8	2941.0	O K
1440 min Winter	0.226	0.226	14.7	2855.3	O K
2160 min Winter	0.215	0.215	14.7	2717.2	O K
2880 min Winter	0.208	0.208	14.6	2622.4	O K
4320 min Winter	0.197	0.197	14.5	2479.5	O K
5760 min Winter	0.188	0.188	14.5	2368.1	O K
7200 min Winter	0.181	0.181	14.4	2281.2	O K
8640 min Winter	0.176	0.176	14.1	2217.7	O K
10080 min Winter	0.172	0.172	13.8	2169.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	1043.8	66	
120 min Winter	36.932	0.0	1358.7	124	
180 min Winter	27.466	0.0	1543.1	184	
240 min Winter	22.073	0.0	1661.2	242	
360 min Winter	15.975	0.0	1795.4	360	
480 min Winter	12.562	0.0	1862.1	476	
600 min Winter	10.371	0.0	1896.6	592	
720 min Winter	8.843	0.0	1912.7	708	
960 min Winter	6.842	0.0	1912.1	934	
1440 min Winter	4.743	0.0	1847.8	1368	
2160 min Winter	3.288	0.0	2824.6	1692	
2880 min Winter	2.547	0.0	2851.1	2136	
4320 min Winter	1.811	0.0	2838.9	3028	
5760 min Winter	1.443	0.0	3823.4	3864	
7200 min Winter	1.224	0.0	4009.1	4680	
8640 min Winter	1.080	0.0	4173.9	5448	
10080 min Winter	0.980	0.0	4300.7	6256	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.690

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	1.845	4 8	1.845

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		Micro Drainage																																																																																																			
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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0180-1480-0500-1480 Design Head (m) 0.500 Design Flow (l/s) 14.8 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 180 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>14.8</td></tr><tr><td>Flush-Flo™</td><td>0.259</td><td>14.8</td></tr><tr><td>Kick-Flo®</td><td>0.416</td><td>13.6</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>11.4</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>6.3</td><td>1.200</td><td>22.4</td><td>3.000</td><td>34.8</td><td>7.000</td><td>52.5</td></tr><tr><td>0.200</td><td>14.6</td><td>1.400</td><td>24.1</td><td>3.500</td><td>37.5</td><td>7.500</td><td>54.3</td></tr><tr><td>0.300</td><td>14.7</td><td>1.600</td><td>25.7</td><td>4.000</td><td>40.0</td><td>8.000</td><td>56.1</td></tr><tr><td>0.400</td><td>13.8</td><td>1.800</td><td>27.2</td><td>4.500</td><td>42.4</td><td>8.500</td><td>57.9</td></tr><tr><td>0.500</td><td>14.8</td><td>2.000</td><td>28.7</td><td>5.000</td><td>44.6</td><td>9.000</td><td>59.6</td></tr><tr><td>0.600</td><td>16.1</td><td>2.200</td><td>30.0</td><td>5.500</td><td>46.4</td><td>9.500</td><td>61.2</td></tr><tr><td>0.800</td><td>18.5</td><td>2.400</td><td>31.3</td><td>6.000</td><td>48.5</td><td></td><td></td></tr><tr><td>1.000</td><td>20.6</td><td>2.600</td><td>32.5</td><td>6.500</td><td>50.5</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3		Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	14.8	Flush-Flo™	0.259	14.8	Kick-Flo®	0.416	13.6	Mean Flow over Head Range	-	11.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.3	1.200	22.4	3.000	34.8	7.000	52.5	0.200	14.6	1.400	24.1	3.500	37.5	7.500	54.3	0.300	14.7	1.600	25.7	4.000	40.0	8.000	56.1	0.400	13.8	1.800	27.2	4.500	42.4	8.500	57.9	0.500	14.8	2.000	28.7	5.000	44.6	9.000	59.6	0.600	16.1	2.200	30.0	5.500	46.4	9.500	61.2	0.800	18.5	2.400	31.3	6.000	48.5			1.000	20.6	2.600	32.5	6.500	50.5		
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)																																																																																																
0.000	12500.0	0.700	13346.2	1.000	13717.3																																																																																																
	Head (m)	Flow (l/s)																																																																																																			
Design Point (Calculated)	0.500	14.8																																																																																																			
Flush-Flo™	0.259	14.8																																																																																																			
Kick-Flo®	0.416	13.6																																																																																																			
Mean Flow over Head Range	-	11.4																																																																																																			
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																														
0.100	6.3	1.200	22.4	3.000	34.8	7.000	52.5																																																																																														
0.200	14.6	1.400	24.1	3.500	37.5	7.500	54.3																																																																																														
0.300	14.7	1.600	25.7	4.000	40.0	8.000	56.1																																																																																														
0.400	13.8	1.800	27.2	4.500	42.4	8.500	57.9																																																																																														
0.500	14.8	2.000	28.7	5.000	44.6	9.000	59.6																																																																																														
0.600	16.1	2.200	30.0	5.500	46.4	9.500	61.2																																																																																														
0.800	18.5	2.400	31.3	6.000	48.5																																																																																																
1.000	20.6	2.600	32.5	6.500	50.5																																																																																																
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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.222	0.222	32.7	2803.9	O K
30 min Summer	0.284	0.284	39.0	3598.4	O K
60 min Summer	0.344	0.344	39.6	4367.6	O K
120 min Summer	0.417	0.417	39.6	5316.2	O K
180 min Summer	0.459	0.459	39.6	5866.5	O K
240 min Summer	0.486	0.486	39.6	6219.2	O K
360 min Summer	0.516	0.516	40.2	6603.7	O K
480 min Summer	0.528	0.528	40.7	6770.2	O K
600 min Summer	0.533	0.533	40.8	6830.0	O K
720 min Summer	0.533	0.533	40.8	6830.4	O K
960 min Summer	0.525	0.525	40.5	6727.6	O K
1440 min Summer	0.502	0.502	39.7	6421.9	O K
2160 min Summer	0.475	0.475	39.6	6068.6	O K
2880 min Summer	0.453	0.453	39.6	5780.3	O K
4320 min Summer	0.420	0.420	39.6	5352.4	O K
5760 min Summer	0.394	0.394	39.6	5016.8	O K
7200 min Summer	0.373	0.373	39.6	4748.1	O K
8640 min Summer	0.356	0.356	39.6	4532.1	O K
10080 min Summer	0.343	0.343	39.6	4362.0	O K
15 min Winter	0.248	0.248	37.5	3139.4	O K
30 min Winter	0.318	0.318	39.4	4034.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	1542.0	23	
30 min Summer	98.091	0.0	2126.4	38	
60 min Summer	59.966	0.0	3470.7	68	
120 min Summer	36.932	0.0	4326.3	126	
180 min Summer	27.466	0.0	4812.6	186	
240 min Summer	22.073	0.0	5121.7	246	
360 min Summer	15.975	0.0	5473.3	364	
480 min Summer	12.562	0.0	5645.9	484	
600 min Summer	10.371	0.0	5730.5	604	
720 min Summer	8.843	0.0	5763.3	722	
960 min Summer	6.842	0.0	5731.9	960	
1440 min Summer	4.743	0.0	5452.1	1228	
2160 min Summer	3.288	0.0	7876.2	1580	
2880 min Summer	2.547	0.0	8039.1	1964	
4320 min Summer	1.811	0.0	8247.6	2768	
5760 min Summer	1.443	0.0	9871.5	3568	
7200 min Summer	1.224	0.0	10418.1	4328	
8640 min Summer	1.080	0.0	10944.1	5104	
10080 min Summer	0.980	0.0	11413.8	5856	
15 min Winter	152.119	0.0	1789.6	23	
30 min Winter	98.091	0.0	2417.6	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.385	0.385	39.6	4899.9	O K
120 min Winter	0.467	0.467	39.6	5970.4	O K
180 min Winter	0.515	0.515	40.2	6590.9	O K
240 min Winter	0.545	0.545	41.3	6987.3	O K
360 min Winter	0.578	0.578	42.4	7424.6	O K
480 min Winter	0.593	0.593	43.0	7619.7	O K
600 min Winter	0.599	0.599	43.2	7696.9	O K
720 min Winter	0.599	0.599	43.2	7708.2	O K
960 min Winter	0.593	0.593	43.0	7618.8	O K
1440 min Winter	0.567	0.567	42.1	7280.1	O K
2160 min Winter	0.530	0.530	40.7	6797.6	O K
2880 min Winter	0.501	0.501	39.6	6415.1	O K
4320 min Winter	0.451	0.451	39.6	5762.9	O K
5760 min Winter	0.408	0.408	39.6	5202.6	O K
7200 min Winter	0.373	0.373	39.6	4745.3	O K
8640 min Winter	0.344	0.344	39.6	4374.7	O K
10080 min Winter	0.321	0.321	39.5	4079.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	3926.1	66	
120 min Winter	36.932	0.0	4845.8	124	
180 min Winter	27.466	0.0	5353.4	184	
240 min Winter	22.073	0.0	5669.3	242	
360 min Winter	15.975	0.0	6007.1	360	
480 min Winter	12.562	0.0	6149.9	476	
600 min Winter	10.371	0.0	6198.2	590	
720 min Winter	8.843	0.0	6191.4	706	
960 min Winter	6.842	0.0	6077.3	930	
1440 min Winter	4.743	0.0	5688.9	1356	
2160 min Winter	3.288	0.0	8823.7	1672	
2880 min Winter	2.547	0.0	8979.4	2136	
4320 min Winter	1.811	0.0	9140.0	3028	
5760 min Winter	1.443	0.0	11088.2	3856	
7200 min Winter	1.224	0.0	11711.4	4616	
8640 min Winter	1.080	0.0	12314.6	5368	
10080 min Winter	0.980	0.0	12862.0	6152	
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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0274-3960-0500-3960
Design Head (m)	0.500
Design Flow (l/s)	39.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	274
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	39.6
Flush-Flo™	0.356	39.6
Kick-Flo®	0.467	38.3
Mean Flow over Head Range	-	27.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.6	1.200	60.4	3.000	94.2	7.000	141.7
0.200	28.2	1.400	65.1	3.500	101.6	7.500	146.8
0.300	39.2	1.600	69.4	4.000	108.4	8.000	151.7
0.400	39.4	1.800	73.5	4.500	114.9	8.500	156.5
0.500	39.6	2.000	77.4	5.000	120.9	9.000	161.1
0.600	43.2	2.200	81.0	5.500	125.3	9.500	165.6
0.800	49.6	2.400	84.5	6.000	131.0		
1.000	55.3	2.600	87.9	6.500	136.5		

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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Outflow is too low. Design is unsatisfactory.					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.025	0.025	0.3	307.8	O K
30 min Summer	0.032	0.032	0.5	396.8	O K
60 min Summer	0.039	0.039	0.8	484.4	O K
120 min Summer	0.047	0.047	1.1	594.7	O K
180 min Summer	0.053	0.053	1.4	661.0	O K
240 min Summer	0.056	0.056	1.5	705.6	O K
360 min Summer	0.061	0.061	1.8	760.2	O K
480 min Summer	0.063	0.063	1.9	790.9	O K
600 min Summer	0.065	0.065	1.9	809.9	O K
720 min Summer	0.066	0.066	2.0	822.3	O K
960 min Summer	0.067	0.067	2.0	835.2	O K
1440 min Summer	0.067	0.067	2.1	842.2	O K
2160 min Summer	0.067	0.067	2.0	836.3	O K
2880 min Summer	0.066	0.066	2.0	825.9	O K
4320 min Summer	0.066	0.066	2.0	824.2	O K
5760 min Summer	0.066	0.066	2.0	833.7	O K
7200 min Summer	0.068	0.068	2.1	847.0	O K
8640 min Summer	0.069	0.069	2.1	862.4	O K
10080 min Summer	0.070	0.070	2.2	879.2	O K
15 min Winter	0.028	0.028	0.4	344.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	26.5	23	
30 min Summer	98.091	0.0	41.8	38	
60 min Summer	59.966	0.0	107.2	68	
120 min Summer	36.932	0.0	150.0	128	
180 min Summer	27.466	0.0	177.2	188	
240 min Summer	22.073	0.0	195.9	248	
360 min Summer	15.975	0.0	218.5	366	
480 min Summer	12.562	0.0	230.4	486	
600 min Summer	10.371	0.0	236.9	606	
720 min Summer	8.843	0.0	240.2	726	
960 min Summer	6.842	0.0	240.9	964	
1440 min Summer	4.743	0.0	231.2	1444	
2160 min Summer	3.288	0.0	425.2	2160	
2880 min Summer	2.547	0.0	419.2	2736	
4320 min Summer	1.811	0.0	394.7	3336	
5760 min Summer	1.443	0.0	708.3	4096	
7200 min Summer	1.224	0.0	729.1	4896	
8640 min Summer	1.080	0.0	741.9	5704	
10080 min Summer	0.980	0.0	743.7	6464	
15 min Winter	152.119	0.0	32.6	23	
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<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
30 min Winter	0.035	0.035	0.7	444.3	O K	
60 min Winter	0.043	0.043	1.0	542.4	O K	
120 min Winter	0.053	0.053	1.4	665.7	O K	
180 min Winter	0.059	0.059	1.7	739.9	O K	
240 min Winter	0.063	0.063	1.8	789.7	O K	
360 min Winter	0.068	0.068	2.1	850.5	O K	
480 min Winter	0.071	0.071	2.2	884.7	O K	
600 min Winter	0.072	0.072	2.3	905.7	O K	
720 min Winter	0.073	0.073	2.4	919.3	O K	
960 min Winter	0.074	0.074	2.4	933.4	O K	
1440 min Winter	0.075	0.075	2.4	940.8	O K	
2160 min Winter	0.075	0.075	2.4	934.8	O K	
2880 min Winter	0.074	0.074	2.4	924.0	O K	
4320 min Winter	0.073	0.073	2.4	915.9	O K	
5760 min Winter	0.073	0.073	2.4	920.9	O K	
7200 min Winter	0.074	0.074	2.4	928.0	O K	
8640 min Winter	0.075	0.075	2.4	936.2	O K	
10080 min Winter	0.075	0.075	2.5	945.8	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
30 min Winter	98.091	0.0	51.2	38		
60 min Winter	59.966	0.0	129.6	68		
120 min Winter	36.932	0.0	180.1	126		
180 min Winter	27.466	0.0	212.0	186		
240 min Winter	22.073	0.0	233.7	244		
360 min Winter	15.975	0.0	259.8	362		
480 min Winter	12.562	0.0	273.5	480		
600 min Winter	10.371	0.0	280.9	598		
720 min Winter	8.843	0.0	284.6	714		
960 min Winter	6.842	0.0	285.0	948		
1440 min Winter	4.743	0.0	273.2	1410		
2160 min Winter	3.288	0.0	498.2	2076		
2880 min Winter	2.547	0.0	491.3	2712		
4320 min Winter	1.811	0.0	462.1	3376		
5760 min Winter	1.443	0.0	818.8	4272		
7200 min Winter	1.224	0.0	842.9	5192		
8640 min Winter	1.080	0.0	857.8	6056		
10080 min Winter	0.980	0.0	859.7	6960		
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.080

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.540	4 8	0.540

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-4300-0500-4300
Design Head (m)	0.500
Design Flow (l/s)	4.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	4.3
Flush-Flo™	0.172	4.3
Kick-Flo®	0.368	3.7
Mean Flow over Head Range	-	3.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	6.5	3.000	9.9	7.000	15.0
0.200	4.3	1.400	6.9	3.500	10.7	7.500	15.5
0.300	4.1	1.600	7.4	4.000	11.4	8.000	16.0
0.400	3.9	1.800	7.8	4.500	12.1	8.500	16.5
0.500	4.3	2.000	8.2	5.000	12.7	9.000	17.0
0.600	4.7	2.200	8.6	5.500	13.2	9.500	17.4
0.800	5.3	2.400	8.9	6.000	13.8		
1.000	5.9	2.600	9.3	6.500	14.4		

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<table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>0.030</td><td>0.030</td><td>0.5</td><td>376.2</td><td>O K</td></tr><tr><td>30 min Summer</td><td>0.039</td><td>0.039</td><td>0.8</td><td>484.8</td><td>O K</td></tr><tr><td>60 min Summer</td><td>0.047</td><td>0.047</td><td>1.2</td><td>591.6</td><td>O K</td></tr><tr><td>120 min Summer</td><td>0.058</td><td>0.058</td><td>1.7</td><td>725.7</td><td>O K</td></tr><tr><td>180 min Summer</td><td>0.064</td><td>0.064</td><td>2.1</td><td>805.9</td><td>O K</td></tr><tr><td>240 min Summer</td><td>0.069</td><td>0.069</td><td>2.3</td><td>859.5</td><td>O K</td></tr><tr><td>360 min Summer</td><td>0.074</td><td>0.074</td><td>2.6</td><td>924.5</td><td>O K</td></tr><tr><td>480 min Summer</td><td>0.077</td><td>0.077</td><td>2.8</td><td>960.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>0.078</td><td>0.078</td><td>2.9</td><td>981.6</td><td>O K</td></tr><tr><td>720 min Summer</td><td>0.079</td><td>0.079</td><td>2.9</td><td>994.9</td><td>O K</td></tr><tr><td>960 min Summer</td><td>0.080</td><td>0.080</td><td>3.0</td><td>1007.2</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>0.080</td><td>0.080</td><td>3.0</td><td>1009.0</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>0.079</td><td>0.079</td><td>2.9</td><td>992.4</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>0.078</td><td>0.078</td><td>2.8</td><td>978.6</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>0.078</td><td>0.078</td><td>2.8</td><td>976.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>0.078</td><td>0.078</td><td>2.9</td><td>984.9</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>0.079</td><td>0.079</td><td>2.9</td><td>997.2</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>0.081</td><td>0.081</td><td>3.0</td><td>1011.6</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>0.082</td><td>0.082</td><td>3.1</td><td>1027.6</td><td>O K</td></tr><tr><td>15 min Winter</td><td>0.034</td><td>0.034</td><td>0.6</td><td>421.3</td><td>O K</td></tr><tr><td>30 min Winter</td><td>0.043</td><td>0.043</td><td>1.0</td><td>542.8</td><td>O K</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	0.030	0.030	0.5	376.2	O K	30 min Summer	0.039	0.039	0.8	484.8	O K	60 min Summer	0.047	0.047	1.2	591.6	O K	120 min Summer	0.058	0.058	1.7	725.7	O K	180 min Summer	0.064	0.064	2.1	805.9	O K	240 min Summer	0.069	0.069	2.3	859.5	O K	360 min Summer	0.074	0.074	2.6	924.5	O K	480 min Summer	0.077	0.077	2.8	960.2	O K	600 min Summer	0.078	0.078	2.9	981.6	O K	720 min Summer	0.079	0.079	2.9	994.9	O K	960 min Summer	0.080	0.080	3.0	1007.2	O K	1440 min Summer	0.080	0.080	3.0	1009.0	O K	2160 min Summer	0.079	0.079	2.9	992.4	O K	2880 min Summer	0.078	0.078	2.8	978.6	O K	4320 min Summer	0.078	0.078	2.8	976.2	O K	5760 min Summer	0.078	0.078	2.9	984.9	O K	7200 min Summer	0.079	0.079	2.9	997.2	O K	8640 min Summer	0.081	0.081	3.0	1011.6	O K	10080 min Summer	0.082	0.082	3.1	1027.6	O K	15 min Winter	0.034	0.034	0.6	421.3	O K	30 min Winter	0.043	0.043	1.0	542.8	O K
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Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)																																																																																																																																						
15 min Summer	152.119	0.0	40.2	23																																																																																																																																						
30 min Summer	98.091	0.0	63.0	38																																																																																																																																						
60 min Summer	59.966	0.0	156.8	68																																																																																																																																						
120 min Summer	36.932	0.0	217.2	128																																																																																																																																						
180 min Summer	27.466	0.0	255.4	188																																																																																																																																						
240 min Summer	22.073	0.0	281.4	248																																																																																																																																						
360 min Summer	15.975	0.0	312.8	366																																																																																																																																						
480 min Summer	12.562	0.0	329.4	486																																																																																																																																						
600 min Summer	10.371	0.0	338.5	606																																																																																																																																						
720 min Summer	8.843	0.0	343.2	724																																																																																																																																						
960 min Summer	6.842	0.0	344.4	964																																																																																																																																						
1440 min Summer	4.743	0.0	331.6	1442																																																																																																																																						
2160 min Summer	3.288	0.0	587.5	2144																																																																																																																																						
2880 min Summer	2.547	0.0	581.3	2452																																																																																																																																						
4320 min Summer	1.811	0.0	551.9	3156																																																																																																																																						
5760 min Summer	1.443	0.0	939.9	3928																																																																																																																																						
7200 min Summer	1.224	0.0	970.7	4760																																																																																																																																						
8640 min Summer	1.080	0.0	991.9	5536																																																																																																																																						
10080 min Summer	0.980	0.0	999.1	6360																																																																																																																																						
15 min Winter	152.119	0.0	49.3	23																																																																																																																																						
30 min Winter	98.091	0.0	76.8	38																																																																																																																																						
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<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
60 min Winter	0.053	0.053	1.5	662.4	O K	
120 min Winter	0.065	0.065	2.1	812.4	O K	
180 min Winter	0.072	0.072	2.5	902.1	O K	
240 min Winter	0.077	0.077	2.8	962.0	O K	
360 min Winter	0.082	0.082	3.1	1034.3	O K	
480 min Winter	0.086	0.086	3.3	1074.0	O K	
600 min Winter	0.087	0.087	3.4	1097.7	O K	
720 min Winter	0.089	0.089	3.5	1112.4	O K	
960 min Winter	0.090	0.090	3.5	1125.9	O K	
1440 min Winter	0.090	0.090	3.5	1127.9	O K	
2160 min Winter	0.089	0.089	3.5	1111.4	O K	
2880 min Winter	0.087	0.087	3.3	1091.3	O K	
4320 min Winter	0.086	0.086	3.3	1082.2	O K	
5760 min Winter	0.086	0.086	3.3	1081.6	O K	
7200 min Winter	0.086	0.086	3.3	1083.7	O K	
8640 min Winter	0.087	0.087	3.3	1087.8	O K	
10080 min Winter	0.087	0.087	3.4	1093.7	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
60 min Winter	59.966	0.0	188.4	68		
120 min Winter	36.932	0.0	259.2	126		
180 min Winter	27.466	0.0	303.6	184		
240 min Winter	22.073	0.0	333.6	244		
360 min Winter	15.975	0.0	369.6	362		
480 min Winter	12.562	0.0	388.5	478		
600 min Winter	10.371	0.0	398.7	596		
720 min Winter	8.843	0.0	403.8	714		
960 min Winter	6.842	0.0	404.7	944		
1440 min Winter	4.743	0.0	389.1	1400		
2160 min Winter	3.288	0.0	684.3	2056		
2880 min Winter	2.547	0.0	677.1	2652		
4320 min Winter	1.811	0.0	642.6	3284		
5760 min Winter	1.443	0.0	1081.3	4200		
7200 min Winter	1.224	0.0	1117.1	5112		
8640 min Winter	1.080	0.0	1141.8	5960		
10080 min Winter	0.980	0.0	1150.1	6768		
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.320

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.660	4 8	0.660

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0115-5300-0500-5300
Design Head (m)	0.500
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	115
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	5.3
Flush-Flo™	0.182	5.3
Kick-Flo®	0.374	4.6
Mean Flow over Head Range	-	4.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	1.200	8.0	3.000	12.3	7.000	18.5
0.200	5.3	1.400	8.6	3.500	13.2	7.500	19.2
0.300	5.1	1.600	9.1	4.000	14.1	8.000	19.8
0.400	4.8	1.800	9.7	4.500	14.9	8.500	20.4
0.500	5.3	2.000	10.1	5.000	15.7	9.000	21.0
0.600	5.8	2.200	10.6	5.500	16.4	9.500	21.6
0.800	6.6	2.400	11.1	6.000	17.1		
1.000	7.3	2.600	11.5	6.500	17.8		

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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.883	0.883	163.2	11506.3	Flood Risk
30 min Summer	1.122	1.122	172.6	14775.4	FLOOD
60 min Summer	1.349	1.349	188.8	17890.6	FLOOD
120 min Summer	1.623	1.623	206.7	21645.5	FLOOD
180 min Summer	1.774	1.774	215.9	23725.2	FLOOD
240 min Summer	1.866	1.866	221.3	24982.7	FLOOD
360 min Summer	1.955	1.955	226.4	26203.4	FLOOD
480 min Summer	1.979	1.979	227.8	26537.5	FLOOD
600 min Summer	1.973	1.973	227.4	26449.6	FLOOD
720 min Summer	1.949	1.949	226.1	26128.3	FLOOD
960 min Summer	1.883	1.883	222.3	25221.1	FLOOD
1440 min Summer	1.770	1.770	215.6	23662.6	FLOOD
2160 min Summer	1.630	1.630	207.2	21746.0	FLOOD
2880 min Summer	1.515	1.515	199.9	20168.4	FLOOD
4320 min Summer	1.346	1.346	188.6	17845.6	FLOOD
5760 min Summer	1.221	1.221	179.9	16135.0	FLOOD
7200 min Summer	1.125	1.125	172.8	14816.1	FLOOD
8640 min Summer	1.049	1.049	167.0	13773.0	FLOOD
10080 min Summer	0.988	0.988	163.2	12936.1	Flood Risk
15 min Winter	0.985	0.985	163.2	12897.8	Flood Risk
30 min Winter	1.252	1.252	182.1	16565.9	FLOOD
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	152.119	0.0	9632.0	23	
30 min Summer	98.091	1671.5	12134.3	37	
60 min Summer	59.966	4786.6	17181.9	68	
120 min Summer	36.932	8541.6	21132.2	126	
180 min Summer	27.466	10621.3	23482.1	186	
240 min Summer	22.073	11878.8	25045.8	246	
360 min Summer	15.975	13099.5	26920.4	364	
480 min Summer	12.562	13433.6	27925.6	482	
600 min Summer	10.371	13345.7	28484.9	602	
720 min Summer	8.843	13024.4	28765.8	720	
960 min Summer	6.842	12117.2	28751.2	842	
1440 min Summer	4.743	10558.7	27482.7	1082	
2160 min Summer	3.288	8642.1	35392.5	1472	
2880 min Summer	2.547	7064.5	36429.6	1880	
4320 min Summer	1.811	4741.6	38294.7	2720	
5760 min Summer	1.443	3031.1	42058.5	3512	
7200 min Summer	1.224	1712.2	44538.9	4320	
8640 min Summer	1.080	669.0	47048.0	5096	
10080 min Summer	0.980	0.0	49516.8	5856	
15 min Winter	152.119	0.0	10729.7	23	
30 min Winter	98.091	3462.0	13242.5	37	
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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	1.508	1.508	199.4	20069.3	FLOOD
120 min Winter	1.817	1.817	218.4	24306.4	FLOOD
180 min Winter	1.989	1.989	228.3	26676.1	FLOOD
240 min Winter	2.095	2.095	234.2	28127.3	FLOOD
360 min Winter	2.201	2.201	239.9	29577.2	FLOOD
480 min Winter	2.235	2.235	241.7	30040.1	FLOOD
600 min Winter	2.234	2.234	241.7	30033.1	FLOOD
720 min Winter	2.215	2.215	240.7	29771.8	FLOOD
960 min Winter	2.147	2.147	237.0	28843.5	FLOOD
1440 min Winter	2.000	2.000	228.9	26820.7	FLOOD
2160 min Winter	1.822	1.822	218.7	24373.5	FLOOD
2880 min Winter	1.666	1.666	209.4	22246.1	FLOOD
4320 min Winter	1.427	1.427	194.1	18955.6	FLOOD
5760 min Winter	1.244	1.244	181.5	16449.7	FLOOD
7200 min Winter	1.099	1.099	170.9	14457.8	FLOOD
8640 min Winter	0.977	0.977	163.2	12790.9	Flood Risk
10080 min Winter	0.857	0.857	163.2	11154.3	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	6965.4	19250.7	66	
120 min Winter	36.932	11202.5	23605.4	124	
180 min Winter	27.466	13572.2	26152.3	182	
240 min Winter	22.073	15023.3	27806.6	240	
360 min Winter	15.975	16473.3	29684.4	358	
480 min Winter	12.562	16936.1	30557.4	472	
600 min Winter	10.371	16929.1	30899.8	586	
720 min Winter	8.843	16667.9	30905.7	696	
960 min Winter	6.842	15739.6	30476.3	910	
1440 min Winter	4.743	13716.7	29209.0	1138	
2160 min Winter	3.288	11269.6	39647.1	1588	
2880 min Winter	2.547	9142.2	40791.2	2048	
4320 min Winter	1.811	5851.7	42736.8	2904	
5760 min Winter	1.443	3345.8	47132.1	3752	
7200 min Winter	1.224	1353.9	49927.3	4608	
8640 min Winter	1.080	0.0	52763.6	5440	
10080 min Winter	0.980	0.0	55586.1	6160	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 40.800

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	20.400	4 8	20.400

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Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	12500.0	0.700	13346.2	1.000	13717.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0486-1632-1000-1632
Design Head (m)	1.000
Design Flow (l/s)	163.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	486
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	500
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	163.2
Flush-Flo™	0.643	163.2
Kick-Flo®	0.900	155.0
Mean Flow over Head Range	-	117.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	12.4	1.200	178.4	3.000	279.3	7.000	423.5
0.200	45.4	1.400	192.3	3.500	301.2	7.500	438.2
0.300	91.6	1.600	205.3	4.000	321.6	8.000	452.3
0.400	140.9	1.800	217.4	4.500	340.8	8.500	466.1
0.500	160.2	2.000	228.9	5.000	358.9	9.000	479.4
0.600	163.0	2.200	239.9	5.500	376.1	9.500	492.3
0.800	160.2	2.400	250.3	6.000	392.6		
1.000	163.2	2.600	260.3	6.500	408.4		

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Summary of Results for 100 year Return Period (+40%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
15 min Summer	0.251	0.251	39.2	3170.3	O K	
30 min Summer	0.321	0.321	44.0	4069.7	O K	
60 min Summer	0.388	0.388	44.7	4939.7	O K	
120 min Summer	0.470	0.470	44.8	6011.3	O K	
180 min Summer	0.518	0.518	44.8	6630.9	O K	
240 min Summer	0.548	0.548	44.8	7027.7	O K	
360 min Summer	0.581	0.581	44.8	7464.9	O K	
480 min Summer	0.596	0.596	44.8	7657.5	O K	
600 min Summer	0.601	0.601	44.8	7729.4	O K	
720 min Summer	0.601	0.601	44.8	7732.4	O K	
960 min Summer	0.592	0.592	44.8	7616.2	O K	
1440 min Summer	0.564	0.564	44.8	7239.6	O K	
2160 min Summer	0.531	0.531	44.8	6807.7	O K	
2880 min Summer	0.506	0.506	44.8	6473.8	O K	
4320 min Summer	0.468	0.468	44.8	5978.1	O K	
5760 min Summer	0.438	0.438	44.8	5588.3	O K	
7200 min Summer	0.414	0.414	44.8	5276.6	O K	
8640 min Summer	0.395	0.395	44.7	5025.8	O K	
10080 min Summer	0.379	0.379	44.6	4827.9	O K	
15 min Winter	0.280	0.280	43.2	3550.2	O K	
30 min Winter	0.359	0.359	44.5	4562.6	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	152.119	0.0	1832.3	23		
30 min Summer	98.091	0.0	2495.6	38		
60 min Summer	59.966	0.0	4013.3	68		
120 min Summer	36.932	0.0	4985.8	126		
180 min Summer	27.466	0.0	5539.6	186		
240 min Summer	22.073	0.0	5891.1	246		
360 min Summer	15.975	0.0	6282.3	366		
480 min Summer	12.562	0.0	6466.2	484		
600 min Summer	10.371	0.0	6550.2	604		
720 min Summer	8.843	0.0	6576.4	722		
960 min Summer	6.842	0.0	6525.2	962		
1440 min Summer	4.743	0.0	6201.0	1240		
2160 min Summer	3.288	0.0	9005.3	1576		
2880 min Summer	2.547	0.0	9196.6	1964		
4320 min Summer	1.811	0.0	9443.8	2768		
5760 min Summer	1.443	0.0	11220.3	3568		
7200 min Summer	1.224	0.0	11846.8	4328		
8640 min Summer	1.080	0.0	12452.8	5104		
10080 min Summer	0.980	0.0	12999.0	5856		
15 min Winter	152.119	0.0	2116.5	23		
30 min Winter	98.091	0.0	2820.7	37		
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.434	0.434	44.8	5541.8	O K
120 min Winter	0.527	0.527	44.8	6750.0	O K
180 min Winter	0.580	0.580	44.8	7452.9	O K
240 min Winter	0.614	0.614	44.8	7906.1	O K
360 min Winter	0.653	0.653	44.8	8414.5	O K
480 min Winter	0.670	0.670	44.8	8648.9	O K
600 min Winter	0.678	0.678	44.8	8749.1	O K
720 min Winter	0.680	0.680	44.8	8772.7	O K
960 min Winter	0.673	0.673	44.8	8685.8	O K
1440 min Winter	0.644	0.644	44.8	8302.8	O K
2160 min Winter	0.597	0.597	44.8	7674.8	O K
2880 min Winter	0.561	0.561	44.8	7200.0	O K
4320 min Winter	0.502	0.502	44.8	6427.9	O K
5760 min Winter	0.453	0.453	44.8	5791.9	O K
7200 min Winter	0.413	0.413	44.8	5269.9	O K
8640 min Winter	0.381	0.381	44.6	4844.6	O K
10080 min Winter	0.354	0.354	44.4	4505.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.966	0.0	4530.6	66	
120 min Winter	36.932	0.0	5577.4	124	
180 min Winter	27.466	0.0	6149.0	184	
240 min Winter	22.073	0.0	6491.5	242	
360 min Winter	15.975	0.0	6827.3	360	
480 min Winter	12.562	0.0	6938.7	476	
600 min Winter	10.371	0.0	6946.4	594	
720 min Winter	8.843	0.0	6898.7	708	
960 min Winter	6.842	0.0	6720.7	936	
1440 min Winter	4.743	0.0	6309.4	1372	
2160 min Winter	3.288	0.0	10065.6	1704	
2880 min Winter	2.547	0.0	10263.1	2136	
4320 min Winter	1.811	0.0	10467.4	3024	
5760 min Winter	1.443	0.0	12598.6	3856	
7200 min Winter	1.224	0.0	13311.5	4616	
8640 min Winter	1.080	0.0	14005.3	5368	
10080 min Winter	0.980	0.0	14641.1	6152	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 11.200

Time (mins)	Area		Time (mins)	Area
From:	To:	(ha)	From:	To:
		(ha)		
0	4	5.600	4	8
		5.600		

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WSP Group Ltd		Page 4																																																																																																			
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Model Details Storage is Online Cover Level (m) 1.000 Tank or Pond Structure Invert Level (m) 0.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>12500.0</td><td>0.700</td><td>13346.2</td><td>1.000</td><td>13717.3</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0281-4480-1000-4480 Design Head (m) 1.000 Design Flow (l/s) 44.8 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 281 Invert Level (m) 0.000 Minimum Outlet Pipe Diameter (mm) 300 Suggested Manhole Diameter (mm) 1800 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>44.8</td></tr><tr><td>Flush-Flo™</td><td>0.429</td><td>44.8</td></tr><tr><td>Kick-Flo®</td><td>0.774</td><td>39.6</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>36.2</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>8.8</td><td>1.200</td><td>48.9</td><td>3.000</td><td>76.2</td><td>7.000</td><td>115.1</td></tr><tr><td>0.200</td><td>28.9</td><td>1.400</td><td>52.7</td><td>3.500</td><td>82.1</td><td>7.500</td><td>119.1</td></tr><tr><td>0.300</td><td>43.7</td><td>1.600</td><td>56.2</td><td>4.000</td><td>87.6</td><td>8.000</td><td>122.9</td></tr><tr><td>0.400</td><td>44.7</td><td>1.800</td><td>59.5</td><td>4.500</td><td>92.8</td><td>8.500</td><td>126.6</td></tr><tr><td>0.500</td><td>44.5</td><td>2.000</td><td>62.6</td><td>5.000</td><td>97.7</td><td>9.000</td><td>130.2</td></tr><tr><td>0.600</td><td>43.6</td><td>2.200</td><td>65.6</td><td>5.500</td><td>102.3</td><td>9.500</td><td>133.7</td></tr><tr><td>0.800</td><td>40.2</td><td>2.400</td><td>68.4</td><td>6.000</td><td>106.8</td><td></td><td></td></tr><tr><td>1.000</td><td>44.8</td><td>2.600</td><td>71.1</td><td>6.500</td><td>111.0</td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	12500.0	0.700	13346.2	1.000	13717.3		Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	44.8	Flush-Flo™	0.429	44.8	Kick-Flo®	0.774	39.6	Mean Flow over Head Range	-	36.2	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	8.8	1.200	48.9	3.000	76.2	7.000	115.1	0.200	28.9	1.400	52.7	3.500	82.1	7.500	119.1	0.300	43.7	1.600	56.2	4.000	87.6	8.000	122.9	0.400	44.7	1.800	59.5	4.500	92.8	8.500	126.6	0.500	44.5	2.000	62.6	5.000	97.7	9.000	130.2	0.600	43.6	2.200	65.6	5.500	102.3	9.500	133.7	0.800	40.2	2.400	68.4	6.000	106.8			1.000	44.8	2.600	71.1	6.500	111.0		
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XP Solutions	Source Control 2018.1.1	
<u>IH 124 Mean Annual Flood</u> Input Return Period (years) 1 Soil 0.450 Area (ha) 50.000 Urban 0.000 SAAR (mm) 650 Region Number Region 4 Results l/s QBAR Rural 201.4 QBAR Urban 201.4 $201.4/50 = 4.0281\text{l/s/ha}$ Q1 year 167.2 Q1 year 167.2 Q2 years 180.5 Q5 years 247.7 Q10 years 300.1 Q20 years 358.0 Q25 years 378.3 Q30 years 394.6 Q50 years 443.5 Q100 years 517.6 Q200 years 608.3 Q250 years 638.5 Q1000 years 837.9		
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Area Summary for TONGWELL -1.SWS <table><thead><tr><th>Pipe Number</th><th>PIMP Type</th><th>PIMP Name</th><th>PIMP (%)</th><th>Gross Area (ha)</th><th>Imp. Area (ha)</th><th>Pipe Total (ha)</th></tr></thead><tbody><tr><td>1.000</td><td>User</td><td>-</td><td>100</td><td>0.596</td><td>0.596</td><td>0.596</td></tr><tr><td>1.001</td><td>User</td><td>-</td><td>100</td><td>0.582</td><td>0.582</td><td>0.582</td></tr><tr><td>1.002</td><td>User</td><td>-</td><td>100</td><td>0.072</td><td>0.072</td><td>0.072</td></tr><tr><td>1.003</td><td>-</td><td>-</td><td>100</td><td>0.000</td><td>0.000</td><td>0.000</td></tr><tr><td>1.004</td><td>User</td><td>-</td><td>100</td><td>0.116</td><td>0.116</td><td>0.116</td></tr><tr><td>1.005</td><td>User</td><td>-</td><td>100</td><td>0.152</td><td>0.152</td><td>0.152</td></tr><tr><td>1.006</td><td>User</td><td>-</td><td>100</td><td>0.231</td><td>0.231</td><td>0.231</td></tr><tr><td>1.007</td><td>User</td><td>-</td><td>100</td><td>0.113</td><td>0.113</td><td>0.113</td></tr><tr><td>1.008</td><td>-</td><td>-</td><td>100</td><td>0.000</td><td>0.000</td><td>0.000</td></tr><tr><td>1.009</td><td>-</td><td>-</td><td>100</td><td>0.000</td><td>0.000</td><td>0.000</td></tr><tr><td colspan="4"></td><td>Total</td><td>Total</td><td>Total</td></tr><tr><td colspan="4"></td><td>1.862</td><td>1.862</td><td>1.862</td></tr></tbody></table> Free Flowing Outfall Details for TONGWELL -1.SWS <table><thead><tr><th>Outfall Pipe Number</th><th>Outfall Name</th><th>C. Level (m)</th><th>I. Level (m)</th><th>Min I. Level (m)</th><th>D,L (mm)</th><th>W (mm)</th></tr></thead><tbody><tr><td>S1.009</td><td>S8</td><td>62.000</td><td>60.374</td><td>0.000</td><td>0</td><td>0</td></tr></tbody></table> Simulation Criteria for TONGWELL -1.SWS <table><tbody><tr><td>Volumetric Runoff Coeff</td><td>0.750</td><td>Additional Flow - % of Total Flow</td><td>0.000</td></tr><tr><td>Areal Reduction Factor</td><td>1.000</td><td>MADD Factor * 10m³/ha Storage</td><td>2.000</td></tr><tr><td>Hot Start (mins)</td><td>0</td><td>Inlet Coefficient</td><td>0.800</td></tr><tr><td>Hot Start Level (mm)</td><td>0</td><td>Flow per Person per Day (l/per/day)</td><td>0.000</td></tr><tr><td>Manhole Headloss Coeff (Global)</td><td>0.500</td><td>Run Time (mins)</td><td>60</td></tr><tr><td>Foul Sewage per hectare (l/s)</td><td>0.000</td><td>Output Interval (mins)</td><td>1</td></tr></tbody></table> Number of Input Hydrographs 0 Number of Storage Structures 2 Number of Online Controls 2 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details <table><tbody><tr><td>Rainfall Model</td><td>FEH</td></tr><tr><td>Return Period (years)</td><td>2</td></tr><tr><td>FEH Rainfall Version</td><td>2013</td></tr><tr><td>Site Location</td><td>GB 489026 242081 SP 89026 42081</td></tr><tr><td>Data Type</td><td>Point</td></tr><tr><td>Summer Storms</td><td>Yes</td></tr><tr><td>Winter Storms</td><td>Yes</td></tr><tr><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>Storm Duration (mins)</td><td>30</td></tr></tbody></table>							Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)	1.000	User	-	100	0.596	0.596	0.596	1.001	User	-	100	0.582	0.582	0.582	1.002	User	-	100	0.072	0.072	0.072	1.003	-	-	100	0.000	0.000	0.000	1.004	User	-	100	0.116	0.116	0.116	1.005	User	-	100	0.152	0.152	0.152	1.006	User	-	100	0.231	0.231	0.231	1.007	User	-	100	0.113	0.113	0.113	1.008	-	-	100	0.000	0.000	0.000	1.009	-	-	100	0.000	0.000	0.000					Total	Total	Total					1.862	1.862	1.862	Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	S1.009	S8	62.000	60.374	0.000	0	0	Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000	Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000	Hot Start (mins)	0	Inlet Coefficient	0.800	Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	Rainfall Model	FEH	Return Period (years)	2	FEH Rainfall Version	2013	Site Location	GB 489026 242081 SP 89026 42081	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Storm Duration (mins)	30
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<u>Hydro-Brake® Optimum Manhole: S6, DS/PN: S1.008, Volume (m³): 26.1</u>							
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		1.500	8.0	Kick-Flo®		0.925	6.4
Flush-Flo™		0.444	8.0	Mean Flow over Head Range		-	7.0
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated							
Depth (m)		Flow (l/s)		Depth (m)		Flow (l/s)	
0.100		4.4		1.200		7.2	
0.200		7.2		1.400		7.7	
0.300		7.8		1.600		8.2	
0.400		8.0		1.800		8.7	
0.500		8.0		2.000		9.2	
0.600		7.9		2.200		9.6	
0.800		7.3		2.400		10.0	
1.000		6.6		2.600		10.4	
3.000		11.1		7.000		16.6	
3.500		11.9		7.500		17.2	
4.000		12.7		8.000		17.7	
4.500		13.4		8.500		18.2	
5.000		14.1		9.000		18.7	
5.500		14.8		9.500		19.2	
6.000		15.4					
6.500		16.0					
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Storage Structures for TONGWELL -1.SWS Cellular Storage Manhole: S3, DS/PN: S1.002 Invert Level (m) 62.079 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>450.0</td><td>0.0</td><td>1.510</td><td>0.0</td><td>0.0</td></tr><tr><td>1.500</td><td>450.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: S6, DS/PN: S1.008 Invert Level (m) 60.461 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>595.0</td><td>0.0</td><td>1.510</td><td>0.0</td><td>0.0</td></tr><tr><td>1.500</td><td>595.0</td><td>0.0</td><td></td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	450.0	0.0	1.510	0.0	0.0	1.500	450.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	595.0	0.0	1.510	0.0	0.0	1.500	595.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																	
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Network 2018.1.1

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for TONGWELL -1.SWS

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.000	S1	-0.247	0.000	0.51		127.6	OK	
S1.001	S2	-0.133	0.000	0.89		219.7	OK	
S1.002	S3	-0.129	0.000	0.09		19.8	OK	
S1.003	S1	-0.418	0.000	0.09		19.8	OK	
S1.004	S2	-0.406	0.000	0.12		28.4	OK	
S1.005	S3	-0.405	0.000	0.18		49.6	OK	
S1.006	S4	-0.454	0.000	0.06		30.9	OK	
S1.007	S5	-0.279	0.000	0.07		33.0	OK	
S1.008	S6	-0.186	0.000	0.02		8.0	OK	
S1.009	S7	-0.675	0.000	0.02		8.0	OK	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.000	S1	1.561	0.000	1.44		359.0	SURCHARGED	
S1.001	S2	1.386	0.000	0.59		145.7	SURCHARGED	
S1.002	S3	1.573	0.000	0.11		23.2	SURCHARGED	
S1.003	S1	0.291	0.000	0.10		21.8	SURCHARGED	
S1.004	S2	0.383	0.000	0.10		24.8	SURCHARGED	
S1.005	S3	1.371	0.000	0.11		30.6	SURCHARGED	
S1.006	S4	1.333	0.000	0.08		38.1	SURCHARGED	
S1.007	S5	1.509	0.000	0.09		41.7	FLOOD RISK	
S1.008	S6	1.602	0.000	0.02		9.8	FLOOD RISK	
S1.009	S7	-0.670	0.000	0.03		9.8	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for TONGWELL -2.SWS

Pipe Sizes HIF 7 Manhole Sizes HIF 7

FEH Rainfall Model

Return Period (years)	10
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for TONGWELL -2.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.186	4-8	0.583	8-12	0.279	12-16	0.001

Total Area Contributing (ha) = 1.050

Total Pipe Volume (m³) = 117.332

Network Design Table for TONGWELL -2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	86.762	1.157	75.0	0.131	5.00	0.0	0.600	o	375	Pipe/Conduit	
S1.001	63.650	0.424	150.0	0.131	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.69	62.200	0.131	0.0	0.0	0.0	2.09	231.3	17.7
S1.001	50.00	6.41	61.043	0.262	0.0	0.0	0.0	1.48	163.1	35.5

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Online Controls for TONGWELL -2.SWS			
Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.008, Volume (m³): 21.8			
Unit Reference MD-SHE-0087-4000-1500-4000 Design Head (m) 1.500 Design Flow (l/s) 4.0 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 87 Invert Level (m) 58.888 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200			
Control Points		Head (m) Flow (l/s)	
Design Point (Calculated)		1.500 4.0	
Flush-Flo™		0.384 3.7	
Control Points		Head (m) Flow (l/s)	
Kick-Flo®		0.780 3.0	
Mean Flow over Head Range		- 3.3	
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated			
Depth (m) Flow (l/s)		Depth (m) Flow (l/s)	
0.100 2.7		1.200 3.6	
0.200 3.4		1.400 3.9	
0.300 3.6		1.600 4.1	
0.400 3.7		1.800 4.4	
0.500 3.6		2.000 4.6	
0.600 3.5		2.200 4.8	
0.800 3.0		2.400 5.0	
1.000 3.3		2.600 5.2	
3.000 5.5		7.000 8.2	
3.500 5.9		7.500 8.5	
4.000 6.3		8.000 8.8	
4.500 6.7		8.500 9.0	
5.000 7.0		9.000 9.3	
5.500 7.3		9.500 9.5	
6.000 7.7			
6.500 8.0			
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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.000	S1	-0.284	0.000	0.13		28.9	OK	
S1.001	S2	-0.221	0.000	0.34		52.1	OK	
S1.002	S3	-0.276	0.000	0.31		75.4	OK	
S1.003	S4	-0.200	0.000	0.58		95.7	OK	
S1.004	S5	-0.273	0.000	0.45		112.8	OK	
S1.005	S6	-0.259	0.000	0.49		124.5	OK	
S1.006	S7	-0.340	0.000	0.38		134.9	OK	
S1.007	S8	-0.261	0.000	0.10		34.0	OK	
S1.008	S9	-0.087	0.000	0.01		3.7	OK	
S1.009	S10	-0.549	0.000	0.02		3.7	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Hif - 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	550
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.900
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Hif - 1

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	8-12	0.886	16-20	3.151	24-28	3.053
4-8	0.000	12-16	2.410	20-24	5.395	28-32	0.037

Total Area Contributing (ha) = 14.932

Total Pipe Volume (m³) = 1567.515

Network Design Table for Hif - 1

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
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Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
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Simulation Criteria for Hif - 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Hif - 1

Hydro-Brake® Optimum Manhole: S24, DS/PN: S1.005, Volume (m³): 47.7

Unit Reference MD-SHE-0215-2460-1200-2460

Design Head (m)1.200

Design Flow (l/s)24.6

Flush-Flo™Calculated

ObjectiveMinimise upstream storage

ApplicationSurface

Sump AvailableYes

Diameter (mm)215

Invert Level (m)56.696

Minimum Outlet Pipe Diameter (mm)300

Suggested Manhole Diameter (mm)1500

Control Points

Head (m)

Flow (l/s)

Design Point (Calculated)

1.200

24.6

Flush-Flo™

0.390

24.6

Control Points

Head (m)

Flow (l/s)

Kick-Flo®

0.845

20.8

Mean Flow over Head Range

-

20.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)

Flow (l/s)

0.100

7.3

0.200

21.0

0.300

24.3

0.400

24.6

0.500

24.3

0.600

23.9

0.800

21.9

1.000

22.6

Depth (m)

Flow (l/s)

1.200

24.6

1.400

26.5

1.600

28.2

1.800

29.9

2.000

31.4

2.200

32.9

2.400

34.3

2.600

35.6

Depth (m)

Flow (l/s)

3.000

38.2

3.500

41.1

4.000

43.9

4.500

46.4

5.000

48.9

5.500

51.2

6.000

53.4

6.500

55.5

Depth (m)

Flow (l/s)

7.000

57.5

7.500

59.5

8.000

61.4

8.500

63.2

9.000

65.0

9.500

66.7

Hydro-Brake® Optimum Manhole: S35, DS/PN: S7.006, Volume (m³): 30.6

Unit Reference MD-SHE-0128-9200-1800-9200

Design Head (m)1.800

Design Flow (l/s)9.2

Flush-Flo™Calculated

ObjectiveMinimise upstream storage

ApplicationSurface

Sump AvailableYes

Diameter (mm)128

Invert Level (m)73.044

Minimum Outlet Pipe Diameter (mm)150

Suggested Manhole Diameter (mm)1500

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Hydro-Brake® Optimum Manhole: S35, DS/PN: S7.006, Volume (m³): 30.6 <table><thead><tr><th colspan="2">Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th colspan="2">Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td colspan="2">Design Point (Calculated)</td><td>1.800</td><td>9.2</td><td colspan="2">Kick-Flo®</td><td>1.086</td><td>7.2</td></tr><tr><td colspan="2">Flush-Flo™</td><td>0.530</td><td>9.1</td><td colspan="2">Mean Flow over Head Range</td><td>-</td><td>8.0</td></tr></tbody></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>4.6</td><td>1.200</td><td>7.6</td><td>3.000</td><td>11.7</td><td>7.000</td><td>17.5</td></tr><tr><td>0.200</td><td>7.8</td><td>1.400</td><td>8.2</td><td>3.500</td><td>12.6</td><td>7.500</td><td>18.1</td></tr><tr><td>0.300</td><td>8.6</td><td>1.600</td><td>8.7</td><td>4.000</td><td>13.4</td><td>8.000</td><td>18.7</td></tr><tr><td>0.400</td><td>9.0</td><td>1.800</td><td>9.2</td><td>4.500</td><td>14.2</td><td>8.500</td><td>19.2</td></tr><tr><td>0.500</td><td>9.1</td><td>2.000</td><td>9.7</td><td>5.000</td><td>14.9</td><td>9.000</td><td>19.8</td></tr><tr><td>0.600</td><td>9.1</td><td>2.200</td><td>10.1</td><td>5.500</td><td>15.6</td><td>9.500</td><td>20.3</td></tr><tr><td>0.800</td><td>8.8</td><td>2.400</td><td>10.5</td><td>6.000</td><td>16.3</td><td></td><td></td></tr><tr><td>1.000</td><td>8.0</td><td>2.600</td><td>10.9</td><td>6.500</td><td>16.9</td><td></td><td></td></tr></tbody></table> Hydro-Brake® Optimum Manhole: S45, DS/PN: S7.012, Volume (m³): 57.3 <table><tbody><tr><td colspan="2">Unit Reference</td><td colspan="2">MD-SHE-0199-2330-1900-2330</td></tr><tr><td colspan="2">Design Head (m)</td><td colspan="2">1.900</td></tr><tr><td colspan="2">Design Flow (l/s)</td><td colspan="2">23.3</td></tr><tr><td colspan="2">Flush-Flo™</td><td colspan="2">Calculated</td></tr><tr><td colspan="2">Objective</td><td colspan="2">Minimise upstream storage</td></tr><tr><td colspan="2">Application</td><td colspan="2">Surface</td></tr><tr><td colspan="2">Sump Available</td><td colspan="2">Yes</td></tr><tr><td colspan="2">Diameter (mm)</td><td colspan="2">199</td></tr><tr><td colspan="2">Invert Level (m)</td><td colspan="2">65.285</td></tr><tr><td colspan="2">Minimum Outlet Pipe Diameter (mm)</td><td colspan="2">225</td></tr><tr><td colspan="2">Suggested Manhole Diameter (mm)</td><td colspan="2">1800</td></tr></tbody></table> <table><thead><tr><th colspan="2">Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th colspan="2">Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td colspan="2">Design Point (Calculated)</td><td>1.900</td><td>23.3</td><td colspan="2">Kick-Flo®</td><td>1.190</td><td>18.6</td></tr><tr><td colspan="2">Flush-Flo™</td><td>0.552</td><td>23.3</td><td colspan="2">Mean Flow over Head Range</td><td>-</td><td>20.2</td></tr></tbody></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>6.9</td><td>0.600</td><td>23.2</td><td>1.600</td><td>21.5</td><td>2.600</td><td>27.1</td></tr><tr><td>0.200</td><td>18.8</td><td>0.800</td><td>22.7</td><td>1.800</td><td>22.7</td><td>3.000</td><td>29.0</td></tr><tr><td>0.300</td><td>21.9</td><td>1.000</td><td>21.5</td><td>2.000</td><td>23.9</td><td>3.500</td><td>31.2</td></tr><tr><td>0.400</td><td>22.9</td><td>1.200</td><td>18.7</td><td>2.200</td><td>25.0</td><td>4.000</td><td>33.3</td></tr><tr><td>0.500</td><td>23.2</td><td>1.400</td><td>20.1</td><td>2.400</td><td>26.0</td><td>4.500</td><td>35.2</td></tr></tbody></table>						Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)	Design Point (Calculated)		1.800	9.2	Kick-Flo®		1.086	7.2	Flush-Flo™		0.530	9.1	Mean Flow over Head Range		-	8.0	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.6	1.200	7.6	3.000	11.7	7.000	17.5	0.200	7.8	1.400	8.2	3.500	12.6	7.500	18.1	0.300	8.6	1.600	8.7	4.000	13.4	8.000	18.7	0.400	9.0	1.800	9.2	4.500	14.2	8.500	19.2	0.500	9.1	2.000	9.7	5.000	14.9	9.000	19.8	0.600	9.1	2.200	10.1	5.500	15.6	9.500	20.3	0.800	8.8	2.400	10.5	6.000	16.3			1.000	8.0	2.600	10.9	6.500	16.9			Unit Reference		MD-SHE-0199-2330-1900-2330		Design Head (m)		1.900		Design Flow (l/s)		23.3		Flush-Flo™		Calculated		Objective		Minimise upstream storage		Application		Surface		Sump Available		Yes		Diameter (mm)		199		Invert Level (m)		65.285		Minimum Outlet Pipe Diameter (mm)		225		Suggested Manhole Diameter (mm)		1800		Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)	Design Point (Calculated)		1.900	23.3	Kick-Flo®		1.190	18.6	Flush-Flo™		0.552	23.3	Mean Flow over Head Range		-	20.2	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.9	0.600	23.2	1.600	21.5	2.600	27.1	0.200	18.8	0.800	22.7	1.800	22.7	3.000	29.0	0.300	21.9	1.000	21.5	2.000	23.9	3.500	31.2	0.400	22.9	1.200	18.7	2.200	25.0	4.000	33.3	0.500	23.2	1.400	20.1	2.400	26.0	4.500	35.2
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Design Flow (l/s)		23.3																																																																																																																																																																																																																							
Flush-Flo™		Calculated																																																																																																																																																																																																																							
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Application		Surface																																																																																																																																																																																																																							
Sump Available		Yes																																																																																																																																																																																																																							
Diameter (mm)		199																																																																																																																																																																																																																							
Invert Level (m)		65.285																																																																																																																																																																																																																							
Minimum Outlet Pipe Diameter (mm)		225																																																																																																																																																																																																																							
Suggested Manhole Diameter (mm)		1800																																																																																																																																																																																																																							
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)																																																																																																																																																																																																																		
Design Point (Calculated)		1.900	23.3	Kick-Flo®		1.190	18.6																																																																																																																																																																																																																		
Flush-Flo™		0.552	23.3	Mean Flow over Head Range		-	20.2																																																																																																																																																																																																																		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																																																																																																																																																		
0.100	6.9	0.600	23.2	1.600	21.5	2.600	27.1																																																																																																																																																																																																																		
0.200	18.8	0.800	22.7	1.800	22.7	3.000	29.0																																																																																																																																																																																																																		
0.300	21.9	1.000	21.5	2.000	23.9	3.500	31.2																																																																																																																																																																																																																		
0.400	22.9	1.200	18.7	2.200	25.0	4.000	33.3																																																																																																																																																																																																																		
0.500	23.2	1.400	20.1	2.400	26.0	4.500	35.2																																																																																																																																																																																																																		
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Hydro-Brake® Optimum Manhole: S45, DS/PN: S7.012, Volume (m³): 57.3 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>5.000</td><td>37.1</td><td>6.500</td><td>42.1</td><td>8.000</td><td>46.5</td><td>9.500</td><td>50.5</td></tr><tr><td>5.500</td><td>38.8</td><td>7.000</td><td>43.6</td><td>8.500</td><td>47.9</td><td></td><td></td></tr><tr><td>6.000</td><td>40.5</td><td>7.500</td><td>45.1</td><td>9.000</td><td>49.2</td><td></td><td></td></tr></table> Hydro-Brake® Optimum Manhole: S69, DS/PN: S11.009, Volume (m³): 318.2 <table><tr><td>Unit Reference</td><td>MD-SHE-0240-3440-1800-3440</td></tr><tr><td>Design Head (m)</td><td>1.800</td></tr><tr><td>Design Flow (l/s)</td><td>34.4</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Application</td><td>Surface</td></tr><tr><td>Sump Available</td><td>Yes</td></tr><tr><td>Diameter (mm)</td><td>240</td></tr><tr><td>Invert Level (m)</td><td>58.691</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>300</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>1800</td></tr></table> <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.800</td><td>34.4</td><td>Kick-Flo®</td><td>1.183</td><td>28.1</td></tr><tr><td>Flush-Flo™</td><td>0.542</td><td>34.3</td><td>Mean Flow over Head Range</td><td>-</td><td>29.6</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.9</td><td>1.200</td><td>28.3</td><td>3.000</td><td>44.0</td><td>7.000</td><td>66.3</td></tr><tr><td>0.200</td><td>24.4</td><td>1.400</td><td>30.5</td><td>3.500</td><td>47.4</td><td>7.500</td><td>68.5</td></tr><tr><td>0.300</td><td>32.4</td><td>1.600</td><td>32.5</td><td>4.000</td><td>50.5</td><td>8.000</td><td>70.7</td></tr><tr><td>0.400</td><td>33.8</td><td>1.800</td><td>34.4</td><td>4.500</td><td>53.5</td><td>8.500</td><td>72.8</td></tr><tr><td>0.500</td><td>34.3</td><td>2.000</td><td>36.2</td><td>5.000</td><td>56.3</td><td>9.000</td><td>74.9</td></tr><tr><td>0.600</td><td>34.3</td><td>2.200</td><td>37.9</td><td>5.500</td><td>59.0</td><td>9.500</td><td>76.9</td></tr><tr><td>0.800</td><td>33.5</td><td>2.400</td><td>39.5</td><td>6.000</td><td>61.5</td><td></td><td></td></tr><tr><td>1.000</td><td>31.9</td><td>2.600</td><td>41.0</td><td>6.500</td><td>63.9</td><td></td><td></td></tr></table>						Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	5.000	37.1	6.500	42.1	8.000	46.5	9.500	50.5	5.500	38.8	7.000	43.6	8.500	47.9			6.000	40.5	7.500	45.1	9.000	49.2			Unit Reference	MD-SHE-0240-3440-1800-3440	Design Head (m)	1.800	Design Flow (l/s)	34.4	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	240	Invert Level (m)	58.691	Minimum Outlet Pipe Diameter (mm)	300	Suggested Manhole Diameter (mm)	1800	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.800	34.4	Kick-Flo®	1.183	28.1	Flush-Flo™	0.542	34.3	Mean Flow over Head Range	-	29.6	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	7.9	1.200	28.3	3.000	44.0	7.000	66.3	0.200	24.4	1.400	30.5	3.500	47.4	7.500	68.5	0.300	32.4	1.600	32.5	4.000	50.5	8.000	70.7	0.400	33.8	1.800	34.4	4.500	53.5	8.500	72.8	0.500	34.3	2.000	36.2	5.000	56.3	9.000	74.9	0.600	34.3	2.200	37.9	5.500	59.0	9.500	76.9	0.800	33.5	2.400	39.5	6.000	61.5			1.000	31.9	2.600	41.0	6.500	63.9		
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Storage Structures for Hif - 1

Tank or Pond Manhole: S24, DS/PN: S1.005

Invert Level (m) 56.696

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2200.0	1.290	3403.1	1.590	3720.4

Tank or Pond Manhole: S35, DS/PN: S7.006

Invert Level (m) 73.044

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	620.0	1.960	1786.7	2.260	2018.6

Tank or Pond Manhole: S45, DS/PN: S7.012

Invert Level (m) 65.285

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	900.0	2.000	2277.6	2.350	2583.3

Tank or Pond Manhole: S69, DS/PN: S11.009

Invert Level (m) 58.691

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1600.0	1.950	3281.2	2.250	3592.8

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S11.006	S62	-0.506	0.000	0.32		401.2	OK	

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5 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Hif - 1

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.000	S01	-0.350	0.000	0.32		217.8	OK	
S1.001	S02	-0.374	0.000	0.40		274.4	OK	
S2.000	S03	-0.286	0.000	0.12		33.4	OK	
S2.001	S04	-0.210	0.000	0.39		74.0	OK	
S2.002	S05	-0.306	0.000	0.23		73.8	OK	
S1.002	S06	-0.231	0.000	0.67		335.9	OK	
S1.003	S07	-0.355	0.000	0.44		423.0	OK	
S1.004	S08	-0.104	0.000	1.00		409.3	OK	
S3.000	S09	-0.273	0.000	0.16		48.1	OK	
S3.001	S10	-0.247	0.000	0.39		59.3	OK	
S3.002	S11	-0.242	0.000	0.43		65.8	OK	
S3.003	S12	-0.282	0.000	0.30		89.1	OK	
S4.000	S13	-0.328	0.000	0.16		54.5	OK	
S4.001	S14	-0.238	0.000	0.43		80.6	OK	
S5.000	S15	-0.252	0.000	0.23		23.8	OK	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S11.006	S62	-0.449	0.000	0.43		538.4	OK	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S11.006	S62	-0.182	0.000	0.82		1036.8	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Hif - 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S11.006	S62	0.911	0.000	1.20		1519.2	SURCHARGED	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for HIF - 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	5
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for HIF - 2

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.328	8-12	6.619	12-16	1.528

Total Area Contributing (ha) = 8.475

Total Pipe Volume (m³) = 641.475

Network Design Table for HIF - 2

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	39.799	0.125	319.2	0.325	5.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.59	58.450	0.325	0.0	0.0	0.0	1.13	180.1	44.0

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Area Summary for HIF - 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.325	0.325	0.325
1.001	User	-	100	0.199	0.199	0.199
1.002	User	-	100	0.055	0.055	0.055
2.000	User	-	100	0.181	0.181	0.181
2.001	User	-	100	0.372	0.372	0.372
2.002	User	-	100	0.477	0.477	0.477
2.003	User	-	100	0.425	0.425	0.425
2.004	User	-	100	0.404	0.404	0.404
2.005	-	-	100	0.000	0.000	0.000
2.006	User	-	100	0.157	0.157	0.157
2.007	User	-	100	0.093	0.093	0.093
1.003	-	-	100	0.000	0.000	0.000
3.000	User	-	40	1.844	0.737	0.737
3.001	User	-	40	1.288	0.515	0.515
3.002	User	-	40	0.512	0.205	0.205
4.000	User	-	100	1.213	1.213	1.213
4.001	User	-	100	0.392	0.392	0.392
4.002	User	-	100	0.121	0.121	0.121
5.000	User	-	100	0.182	0.182	0.182
5.001	User	-	100	0.170	0.170	0.170
5.002	User	-	100	0.216	0.216	0.216
4.003	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.084	0.084	0.084
6.001	User	-	100	0.129	0.129	0.129
6.002	User	-	100	0.177	0.177	0.177
7.000	User	-	100	1.219	1.219	1.219
7.001	User	-	100	0.326	0.326	0.326
7.002	-	-	100	0.000	0.000	0.000
4.004	User	-	100	0.103	0.103	0.103
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				10.661	8.475	8.475

Free Flowing Outfall Details for HIF - 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
S1.004	S	56.500	55.500	0.000	0	0

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Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for HIF - 2		
Hydro-Brake® Optimum Manhole: S129, DS/PN: S1.004, Volume (m³): 264.3		
Unit Reference MD-SHE-0236-3300-1800-3300 Design Head (m)1.800 Design Flow (l/s)33.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)236 Invert Level (m)56.042 Minimum Outlet Pipe Diameter (mm)300 Suggested Manhole Diameter (mm)1800		
Control Points Head (m) Flow (l/s) Design Point (Calculated)1.80032.9 Flush-Flo™0.54432.9 Control Points Head (m) Flow (l/s) Kick-Flo®1.18226.9 Mean Flow over Head Range-28.4		
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated		
Depth (m) Flow (l/s) Depth (m) Flow (l/s) Depth (m) Flow (l/s) Depth (m) Flow (l/s) 0.1007.8 1.20027.1 3.00042.1 7.00063.4 0.20023.8 1.40029.2 3.50045.3 7.50065.6 0.30031.0 1.60031.1 4.00048.4 8.00067.7 0.40032.4 1.80032.9 4.50051.2 8.50069.7 0.50032.9 2.00034.6 5.00053.9 9.00071.7 0.60032.8 2.20036.3 5.50056.4 9.50073.6 0.80032.1 2.40037.8 6.00058.8 1.00030.6 2.60039.3 6.50061.2		
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Simulation Criteria for HIF - 3 Synthetic Rainfall Details <table><tr><td>Rainfall Model</td><td>FEH</td></tr><tr><td>Return Period (years)</td><td>2</td></tr><tr><td>FEH Rainfall Version</td><td>2013</td></tr><tr><td>Site Location</td><td>GB 489026 242081 SP 89026 42081</td></tr><tr><td>Data Type</td><td>Point</td></tr><tr><td>Summer Storms</td><td>Yes</td></tr><tr><td>Winter Storms</td><td>Yes</td></tr><tr><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>Storm Duration (mins)</td><td>30</td></tr></table>			Rainfall Model	FEH	Return Period (years)	2	FEH Rainfall Version	2013	Site Location	GB 489026 242081 SP 89026 42081	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Storm Duration (mins)	30
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<u>Online Controls for HIF - 3</u> <u>Complex Manhole: S306, DS/PN: S3.006, Volume (m³): 34.9</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 71.133 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 73.128 <u>Complex Manhole: S311, DS/PN: S3.008, Volume (m³): 13.9</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 69.438 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 71.388 <u>Complex Manhole: S316, DS/PN: S3.010, Volume (m³): 21.0</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 68.650 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 70.600 <u>Complex Manhole: S321, DS/PN: S3.012, Volume (m³): 40.6</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 67.837 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 69.800		
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<u>Hydro-Brake® Optimum Manhole: S340, DS/PN: S8.005, Volume (m³): 112.5</u>							
Unit Reference MD-SHE-0227-3000-1700-3000							
Design Head (m) 1.700							
Design Flow (l/s) 30.0							
Flush-Flo™ Calculated							
Objective Minimise upstream storage							
Application Surface							
Sump Available Yes							
Diameter (mm) 227							
Invert Level (m) 66.656							
Minimum Outlet Pipe Diameter (mm) 300							
Suggested Manhole Diameter (mm) 1800							
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		1.700	30.0	Kick-Flo®		1.117	24.5
Flush-Flo™		0.510	29.9	Mean Flow over Head Range		-	25.8
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	25.4	3.000	39.4	7.000	59.4
0.200	22.7	1.400	27.3	3.500	42.4	7.500	61.4
0.300	28.6	1.600	29.1	4.000	45.3	8.000	63.3
0.400	29.6	1.800	30.8	4.500	47.9	8.500	65.2
0.500	29.9	2.000	32.4	5.000	50.4	9.000	67.1
0.600	29.8	2.200	33.9	5.500	52.8	9.500	68.9
0.800	29.0	2.400	35.4	6.000	55.1		
1.000	27.1	2.600	36.8	6.500	57.3		
<u>Hydro-Brake® Optimum Manhole: S344, DS/PN: S3.013, Volume (m³): 31.4</u>							
Unit Reference MD-SHE-0173-1600-1500-1600							
Design Head (m) 1.500							
Design Flow (l/s) 16.0							
Flush-Flo™ Calculated							
Objective Minimise upstream storage							
Application Surface							
Sump Available Yes							
Diameter (mm) 173							
Invert Level (m) 66.178							
Minimum Outlet Pipe Diameter (mm) 225							
Suggested Manhole Diameter (mm) 1500							
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		1.500	16.0	Kick-Flo®		0.961	13.0
Flush-Flo™		0.442	16.0	Mean Flow over Head Range		-	13.9
The hydrological calculations have been based on the Head/Discharge relationship for the							
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Hydro-Brake® Optimum Manhole: S344, DS/PN: S3.013, Volume (m³): 31.4

Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m) Flow (l/s)		Depth (m) Flow (l/s)		Depth (m) Flow (l/s)		Depth (m) Flow (l/s)	
0.100	6.1	1.200	14.4	3.000	22.3	7.000	33.5
0.200	14.4	1.400	15.5	3.500	24.0	7.500	34.6
0.300	15.6	1.600	16.5	4.000	25.6	8.000	35.7
0.400	16.0	1.800	17.4	4.500	27.0	8.500	36.7
0.500	15.9	2.000	18.3	5.000	28.4	9.000	37.8
0.600	15.7	2.200	19.2	5.500	29.8	9.500	38.8
0.800	14.9	2.400	20.0	6.000	31.1		
1.000	13.2	2.600	20.8	6.500	32.3		

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<u>Storage Structures for HIF - 3</u> <u>Tank or Pond Manhole: S306, DS/PN: S3.006</u> Invert Level (m) 71.133 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>150.0</td><td>1.000</td><td>445.6</td><td>2.000</td><td>898.3</td><td>2.300</td><td>1064.8</td></tr></table> <u>Tank or Pond Manhole: S311, DS/PN: S3.008</u> Invert Level (m) 69.438 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>50.0</td><td>2.000</td><td>614.8</td><td>3.000</td><td>1132.9</td></tr></table> <u>Tank or Pond Manhole: S316, DS/PN: S3.010</u> Invert Level (m) 68.650 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>150.0</td><td>2.000</td><td>898.3</td><td>2.950</td><td>1473.9</td></tr></table> <u>Tank or Pond Manhole: S321, DS/PN: S3.012</u> Invert Level (m) 67.837 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>150.0</td><td>2.000</td><td>898.3</td><td>2.663</td><td>1285.1</td></tr></table> <u>Tank or Pond Manhole: S340, DS/PN: S8.005</u> Invert Level (m) 66.656 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>400.0</td><td>1.000</td><td>833.0</td><td>1.300</td><td>993.6</td></tr></table> <u>Tank or Pond Manhole: S344, DS/PN: S3.013</u> Invert Level (m) 66.178 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>75.0</td><td>2.000</td><td>696.2</td><td>2.700</td><td>1062.0</td></tr></table>				Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	150.0	1.000	445.6	2.000	898.3	2.300	1064.8	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	50.0	2.000	614.8	3.000	1132.9	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	150.0	2.000	898.3	2.950	1473.9	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	150.0	2.000	898.3	2.663	1285.1	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	400.0	1.000	833.0	1.300	993.6	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	75.0	2.000	696.2	2.700	1062.0
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0.000	75.0	2.000	696.2	2.700	1062.0																																																																										
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Design Criteria for HIF - 4

FEH Rainfall Model	
Return Period (years)	5
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Network Design Table for HIF - 4

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
S1.000	62.892	0.898	70.0	0.228	5.00	0.0	0.600	o	375	Pipe/Conduit		
S2.000	62.067	0.887	70.0	0.232	5.00	0.0	0.600	o	375	Pipe/Conduit		
S2.001	10.903	0.044	247.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit		
S1.001	14.234	0.142	100.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit		
S1.002	69.265	0.150	461.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit		

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.48	76.100	0.228	0.0	0.0	0.0	2.17	239.5	30.8
S2.000	50.00	5.48	76.100	0.232	0.0	0.0	0.0	2.17	239.5	31.5
S2.001	50.00	5.62	75.138	0.232	0.0	0.0	0.0	1.29	204.9	31.5
S1.001	50.00	5.73	75.094	0.460	0.0	0.0	0.0	2.03	323.4	62.3
S1.002	50.00	6.96	72.900	0.460	0.0	0.0	0.0	0.94	149.4	62.3

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Simulation Criteria for HIF - 4

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	5
Number of Online Controls	5	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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<u>Online Controls for HIF - 4</u> <u>Complex Manhole: S409, DS/PN: S1.003, Volume (m³): 18.5</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 72.000 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 74.150 <u>Complex Manhole: S415, DS/PN: S1.005, Volume (m³): 5.9</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 71.500 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 72.650 <u>Complex Manhole: S421, DS/PN: S1.007, Volume (m³): 4.2</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 70.500 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 71.650 <u>Complex Manhole: S427, DS/PN: S1.009, Volume (m³): 4.7</u> <u>Orifice</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 68.800 <u>Weir</u> Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 70.150		
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<u>Hydro-Brake® Optimum Manhole: S435, DS/PN: S1.011, Volume (m³): 5.3</u> Unit Reference MD-SHE-0132-8400-1200-8400 Design Head (m)1.200 Design Flow (l/s)8.4 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)132 Invert Level (m)65.250 Minimum Outlet Pipe Diameter (mm)150 Suggested Manhole Diameter (mm)1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.200</td><td>8.4</td><td>Kick-Flo®</td><td>0.768</td><td>6.8</td></tr><tr><td>Flush-Flo™</td><td>0.357</td><td>8.4</td><td>Mean Flow over Head Range</td><td>-</td><td>7.3</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.7</td><td>1.200</td><td>8.4</td><td>3.000</td><td>12.9</td><td>7.000</td><td>19.4</td></tr><tr><td>0.200</td><td>7.9</td><td>1.400</td><td>9.0</td><td>3.500</td><td>13.9</td><td>7.500</td><td>20.1</td></tr><tr><td>0.300</td><td>8.3</td><td>1.600</td><td>9.6</td><td>4.000</td><td>14.8</td><td>8.000</td><td>20.7</td></tr><tr><td>0.400</td><td>8.4</td><td>1.800</td><td>10.2</td><td>4.500</td><td>15.7</td><td>8.500</td><td>21.3</td></tr><tr><td>0.500</td><td>8.2</td><td>2.000</td><td>10.7</td><td>5.000</td><td>16.5</td><td>9.000</td><td>21.9</td></tr><tr><td>0.600</td><td>8.0</td><td>2.200</td><td>11.2</td><td>5.500</td><td>17.3</td><td>9.500</td><td>22.5</td></tr><tr><td>0.800</td><td>6.9</td><td>2.400</td><td>11.6</td><td>6.000</td><td>18.0</td><td></td><td></td></tr><tr><td>1.000</td><td>7.7</td><td>2.600</td><td>12.1</td><td>6.500</td><td>18.7</td><td></td><td></td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.200	8.4	Kick-Flo®	0.768	6.8	Flush-Flo™	0.357	8.4	Mean Flow over Head Range	-	7.3	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.7	1.200	8.4	3.000	12.9	7.000	19.4	0.200	7.9	1.400	9.0	3.500	13.9	7.500	20.1	0.300	8.3	1.600	9.6	4.000	14.8	8.000	20.7	0.400	8.4	1.800	10.2	4.500	15.7	8.500	21.3	0.500	8.2	2.000	10.7	5.000	16.5	9.000	21.9	0.600	8.0	2.200	11.2	5.500	17.3	9.500	22.5	0.800	6.9	2.400	11.6	6.000	18.0			1.000	7.7	2.600	12.1	6.500	18.7		
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																																							
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0.100	4.7	1.200	8.4	3.000	12.9	7.000	19.4																																																																																					
0.200	7.9	1.400	9.0	3.500	13.9	7.500	20.1																																																																																					
0.300	8.3	1.600	9.6	4.000	14.8	8.000	20.7																																																																																					
0.400	8.4	1.800	10.2	4.500	15.7	8.500	21.3																																																																																					
0.500	8.2	2.000	10.7	5.000	16.5	9.000	21.9																																																																																					
0.600	8.0	2.200	11.2	5.500	17.3	9.500	22.5																																																																																					
0.800	6.9	2.400	11.6	6.000	18.0																																																																																							
1.000	7.7	2.600	12.1	6.500	18.7																																																																																							
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Storage Structures for HIF - 4

Tank or Pond Manhole: S409, DS/PN: S1.003

Invert Level (m) 72.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	500.0	2.000	500.0	2.300	500.0

Tank or Pond Manhole: S415, DS/PN: S1.005

Invert Level (m) 71.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	500.0	1.700	500.0	2.000	500.0

Tank or Pond Manhole: S421, DS/PN: S1.007

Invert Level (m) 70.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	350.0	1.200	350.0	1.500	350.0

Tank or Pond Manhole: S427, DS/PN: S1.009

Invert Level (m) 68.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	400.0	1.400	400.0	1.700	400.0

Tank or Pond Manhole: S435, DS/PN: S1.011

Invert Level (m) 65.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	400.0	1.950	400.0	2.250	400.0

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.000	S400	-0.271	0.000	0.17		37.6	OK	
S2.000	S401	-0.270	0.000	0.17		38.3	OK	
S2.001	S402	-0.280	0.000	0.26		38.6	OK	
S1.001	S403	-0.263	0.000	0.36		76.6	OK	
S1.002	S404	-0.213	0.000	0.55		76.2	OK	
S3.000	S405	-0.292	0.000	0.11		32.2	OK	
S4.000	S406	-0.292	0.000	0.11		32.5	OK	
S4.001	S407	-0.291	0.000	0.27		32.7	OK	
S3.001	S408	-0.362	0.000	0.21		65.4	OK	
S1.003	S409	-0.130	0.000	0.01		2.8	OK	
S5.000	S410	-0.288	0.000	0.12		33.3	OK	
S6.000	S411	-0.290	0.000	0.11		31.9	OK	
S6.001	S412	-0.243	0.000	0.22		32.0	OK	
S5.001	S413	-0.133	0.000	0.74		65.1	OK	
S1.004	S414	-0.291	0.000	0.27		65.3	OK	
S1.005	S415	-0.185	0.000	0.01		2.6	OK	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)	
S1.012	S436	-0.193	0.000	0.05		7.0	OK

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)	
S1.012	S436	-0.191	0.000	0.06		8.0	OK

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.012	S436	-0.190	0.000	0.06		8.3	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for HIF - 4

									Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
S7.000	S416	15 Winter	100	+40%					71.560
S8.000	S417	15 Winter	100	+40%					71.739
S8.001	S418	15 Winter	100	+40%	100/15 Winter				71.363
S7.001	S419	4320 Winter	100	+40%	100/15 Winter				71.262
S1.006	S420	4320 Winter	100	+40%	100/360 Winter				71.263
S1.007	S421	4320 Winter	100	+40%	100/240 Winter				71.261
S9.000	S422	15 Winter	100	+40%					70.645
S10.000	S423	15 Winter	100	+40%					70.646
S10.001	S424	15 Winter	100	+40%					70.373
S9.001	S425	15 Winter	100	+40%					70.286
S1.008	S426	8640 Winter	100	+40%	100/960 Winter				69.539
S1.009	S427	8640 Winter	100	+40%	100/480 Winter				69.538
S11.000	S428	15 Winter	100	+40%	100/15 Winter				69.281
S12.000	S429	15 Winter	100	+40%	100/15 Winter				69.398
S13.000	S430	15 Winter	100	+40%					69.747
S12.001	S431	15 Winter	100	+40%	30/15 Winter				69.065
S14.000	S432	15 Winter	100	+40%					69.754
S11.001	S433	15 Winter	100	+40%	30/15 Winter				68.874
S1.010	S434	360 Winter	100	+40%	30/15 Winter				66.267
S1.011	S435	360 Winter	100	+40%	30/240 Winter				66.264
S1.012	S436	15 Winter	100	+40%					65.299

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S7.000	S416	-0.215	0.000	0.37		80.0		OK
S8.000	S417	-0.236	0.000	0.29		74.8		OK
S8.001	S418	0.075	0.000	0.52		72.3	SURCHARGED	
S7.001	S419	0.101	0.000	0.03		2.4	SURCHARGED	
S1.006	S420	0.213	0.000	0.03		5.9	SURCHARGED	
S1.007	S421	0.311	0.000	0.02		4.5	SURCHARGED	
S9.000	S422	-0.230	0.000	0.31		65.7		OK
S10.000	S423	-0.229	0.000	0.32		66.9		OK
S10.001	S424	-0.109	0.000	0.83		66.3		OK
S9.001	S425	-0.164	0.000	0.60		131.5		OK
S1.008	S426	0.189	0.000	0.03		4.9	SURCHARGED	
S1.009	S427	0.288	0.000	0.01		4.4	SURCHARGED	
S11.000	S428	0.506	0.000	1.22		134.2	SURCHARGED	
S12.000	S429	0.923	0.000	1.13		119.3	FLOOD RISK	
S13.000	S430	-0.228	0.000	0.32		58.3		OK
S12.001	S431	0.816	0.000	1.58		169.6	SURCHARGED	
S14.000	S432	-0.221	0.000	0.35		63.5		OK
S11.001	S433	0.696	0.000	2.35		358.9	SURCHARGED	
S1.010	S434	0.467	0.000	0.34		60.2	SURCHARGED	
S1.011	S435	0.564	0.000	0.02		8.3	SURCHARGED	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.012	S436	-0.189	0.000	0.06		8.4	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for HIF - 5

Pipe Sizes BS Manhole Sizes SFA7

FEH Rainfall Model

Return Period (years)	5
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for HIF - 5

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.000	8-12	1.015	12-16	0.316

Total Area Contributing (ha) = 1.331

Total Pipe Volume (m³) = 71.887

Network Design Table for HIF - 5

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	93.114	0.745	125.0	0.532	5.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.85	66.800	0.532	0.0	0.0	0.0	1.82	289.0	72.0

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Online Controls for HIF - 5		
Hydro-Brake® Optimum Manhole: S505, DS/PN: S1.004, Volume (m³): 14.2		
Unit Reference MD-SHE-0109-5000-0750-5000 Design Head (m) 0.750 Design Flow (l/s) 5.0 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 109 Invert Level (m) 63.067 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200		
Control Points Head (m) Flow (l/s) Design Point (Calculated) 0.750 5.0 Flush-Flo™ 0.226 5.0 Control Points Head (m) Flow (l/s) Kick-Flo® 0.509 4.2 Mean Flow over Head Range - 4.3		
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated		
Depth (m) Flow (l/s) 0.100 3.8 0.200 5.0 0.300 4.9 0.400 4.8 0.500 4.3 0.600 4.5 0.800 5.1 1.000 5.7 Depth (m) Flow (l/s) 1.200 6.2 1.400 6.7 1.600 7.1 1.800 7.5 2.000 7.9 2.200 8.3 2.400 8.6 2.600 8.9 Depth (m) Flow (l/s) 3.000 9.6 3.500 10.3 4.000 11.0 4.500 11.6 5.000 12.2 5.500 12.8 6.000 13.3 6.500 13.8 Depth (m) Flow (l/s) 7.000 14.3 7.500 14.8 8.000 15.2 8.500 15.7 9.000 16.2 9.500 16.6		
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<u>Storage Structures for HIF - 5</u> <u>Tank or Pond Manhole: S505, DS/PN: S1.004</u> Invert Level (m) 63.067 Depth (m) Area (m²) 0.000 1075.0 Depth (m) Area (m²) 0.760 1562.0 Depth (m) Area (m²) 1.068 1785.2		
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for HIF - 5

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S2.000	S502	-0.172	0.000	0.57		60.2	OK	
S1.002	S503	-0.435	0.000	0.17		206.4	OK	
S1.003	S504	-0.447	0.000	0.34		207.3	OK	
S1.004	S505	-0.015	0.000	0.14		5.0	OK	
S1.005	S506	-0.170	0.000	0.14		5.0	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for HIF - 6

Pipe Sizes BS Manhole Sizes SFA7

FEH Rainfall Model

Return Period (years)	5
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for HIF - 6

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.000	8-12	0.586	12-16	2.737	16-20	1.615	20-24	0.313

Total Area Contributing (ha) = 5.252

Total Pipe Volume (m³) = 434.398

Network Design Table for HIF - 6

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	112.844	1.850	61.0	0.918	5.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.65	74.100	0.918	0.0	0.0	0.0	2.87	621.6	124.3

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Online Controls for HIF - 6

Complex Manhole: S602, DS/PN: S1.002, Volume (m³): 10.1

Orifice

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 71.500

Weir

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 73.150

Hydro-Brake® Optimum Manhole: S603, DS/PN: S1.003, Volume (m³): 21.9

Unit Reference	MD-SHE-0095-4000-1000-4000
Design Head (m)	1.000
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	69.870
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.0	Kick-Flo®	0.629	3.2
Flush-Flo™	0.294	4.0	Mean Flow over Head Range	-	3.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.200	4.3	3.000	6.7	7.000	10.0
0.200	3.9	1.400	4.7	3.500	7.2	7.500	10.3
0.300	4.0	1.600	5.0	4.000	7.6	8.000	10.6
0.400	3.9	1.800	5.3	4.500	8.1	8.500	10.9
0.500	3.8	2.000	5.5	5.000	8.5	9.000	11.2
0.600	3.4	2.200	5.8	5.500	8.9	9.500	11.5
0.800	3.6	2.400	6.0	6.000	9.3		
1.000	4.0	2.600	6.2	6.500	9.6		

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Complex Manhole: S623, DS/PN: S1.015, Volume (m³): 36.7																																																																										
Orifice																																																																										
Diameter (m) 0.225 Discharge Coefficient 0.600 Invert Level (m) 64.000																																																																										
Weir																																																																										
Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 66.000																																																																										
Hydro-Brake® Optimum Manhole: S629, DS/PN: S1.017, Volume (m³): 69.6																																																																										
Unit Reference MD-SHE-0196-2100-1500-2100 Design Head (m) 1.500 Design Flow (l/s) 21.0 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 196 Invert Level (m) 63.420 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1500																																																																										
<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.500</td><td>21.0</td><td>Kick-Flo®</td><td>0.989</td><td>17.2</td></tr><tr><td>Flush-Flo™</td><td>0.454</td><td>21.0</td><td>Mean Flow over Head Range</td><td>-</td><td>18.1</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.500	21.0	Kick-Flo®	0.989	17.2	Flush-Flo™	0.454	21.0	Mean Flow over Head Range	-	18.1																																																						
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																					
Design Point (Calculated)	1.500	21.0	Kick-Flo®	0.989	17.2																																																																					
Flush-Flo™	0.454	21.0	Mean Flow over Head Range	-	18.1																																																																					
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated																																																																										
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>6.8</td><td>1.200</td><td>18.9</td><td>3.000</td><td>29.2</td><td>7.000</td><td>44.0</td></tr><tr><td>0.200</td><td>18.3</td><td>1.400</td><td>20.3</td><td>3.500</td><td>31.5</td><td>7.500</td><td>45.5</td></tr><tr><td>0.300</td><td>20.4</td><td>1.600</td><td>21.6</td><td>4.000</td><td>33.6</td><td>8.000</td><td>46.9</td></tr><tr><td>0.400</td><td>20.9</td><td>1.800</td><td>22.9</td><td>4.500</td><td>35.5</td><td>8.500</td><td>48.3</td></tr><tr><td>0.500</td><td>21.0</td><td>2.000</td><td>24.1</td><td>5.000</td><td>37.4</td><td>9.000</td><td>49.7</td></tr><tr><td>0.600</td><td>20.7</td><td>2.200</td><td>25.2</td><td>5.500</td><td>39.1</td><td>9.500</td><td>51.0</td></tr><tr><td>0.800</td><td>19.8</td><td>2.400</td><td>26.3</td><td>6.000</td><td>40.8</td><td></td><td></td></tr><tr><td>1.000</td><td>17.3</td><td>2.600</td><td>27.3</td><td>6.500</td><td>42.4</td><td></td><td></td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.8	1.200	18.9	3.000	29.2	7.000	44.0	0.200	18.3	1.400	20.3	3.500	31.5	7.500	45.5	0.300	20.4	1.600	21.6	4.000	33.6	8.000	46.9	0.400	20.9	1.800	22.9	4.500	35.5	8.500	48.3	0.500	21.0	2.000	24.1	5.000	37.4	9.000	49.7	0.600	20.7	2.200	25.2	5.500	39.1	9.500	51.0	0.800	19.8	2.400	26.3	6.000	40.8			1.000	17.3	2.600	27.3	6.500	42.4		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
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Storage Structures for HIF - 6

Tank or Pond Manhole: S602, DS/PN: S1.002

Invert Level (m) 71.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	200.0	1.700	853.1	2.000	1015.5

Tank or Pond Manhole: S603, DS/PN: S1.003

Invert Level (m) 69.870

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	2.000	768.7	2.300	923.1

Tank or Pond Manhole: S623, DS/PN: S1.015

Invert Level (m) 64.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	325.0	2.000	1228.2	2.400	1489.2

Tank or Pond Manhole: S628, DS/PN: S7.001

Invert Level (m) 63.493

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	500.0	1.200	1088.7	1.500	1271.2

Tank or Pond Manhole: S629, DS/PN: S1.017

Invert Level (m) 63.420

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	500.0	1.280	1136.0	1.580	1322.3

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Water Level									
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
S1.013	S617	15 Winter	100	+40%					67.139
S4.000	S618	120 Winter	100	+40%	100/60 Winter				66.295
S4.001	S619	120 Winter	100	+40%	100/30 Winter				66.295
S1.014	S620	120 Winter	100	+40%	100/30 Winter				66.295
S5.000	S621	120 Winter	100	+40%	100/15 Winter				65.972
S5.001	S622	120 Winter	100	+40%	30/15 Winter				65.963
S1.015	S623	120 Winter	100	+40%	30/15 Winter				65.955
S6.000	S624	15 Winter	100	+40%	100/15 Winter				65.352
S6.001	S625	960 Winter	100	+40%	100/15 Winter				64.928
S1.016	S626	960 Winter	100	+40%	100/240 Winter				64.928
S7.000	S627	960 Winter	100	+40%	100/120 Winter				64.925
S7.001	S628	960 Winter	100	+40%	5/360 Winter				64.925
S1.017	S629	960 Winter	100	+40%	30/360 Winter				64.925
S1.018	S630	960 Winter	100	+40%					63.514
S1.019	S631	960 Winter	100	+40%					62.936
S1.020	S632	960 Winter	100	+40%					62.490
S1.021	S633	960 Winter	100	+40%					62.155

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for HIF - 7

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	10
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for HIF - 7

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.030	8-12	3.901	12-16	12.728	16-20	4.206	20-24	0.062

Total Area Contributing (ha) = 20.926

Total Pipe Volume (m³) = 2588.028

Network Design Table for HIF - 7

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	44.652	0.917	48.7	0.082	5.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.29	73.876	0.082	0.0	0.0	0.0	2.60	287.4	11.0

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Simulation Criteria for HIF - 7 <table><tr><td>Rainfall Model</td><td>FEH</td></tr><tr><td>Return Period (years)</td><td>2</td></tr><tr><td>FEH Rainfall Version</td><td>2013</td></tr><tr><td>Site Location</td><td>GB 489026 242081 SP 89026 42081</td></tr><tr><td>Data Type</td><td>Point</td></tr><tr><td>Summer Storms</td><td>Yes</td></tr><tr><td>Winter Storms</td><td>Yes</td></tr><tr><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>Storm Duration (mins)</td><td>30</td></tr></table>			Rainfall Model	FEH	Return Period (years)	2	FEH Rainfall Version	2013	Site Location	GB 489026 242081 SP 89026 42081	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Storm Duration (mins)	30
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Online Controls for HIF - 7

Hydro-Brake® Optimum Manhole: S763, DS/PN: S1.012, Volume (m³): 172.9

Unit Reference MD-SHE-0266-4300-1800-4300

Design Head (m)1.800

Design Flow (l/s)43.0

Flush-Flo™Calculated

ObjectiveMinimise upstream storage

ApplicationSurface

Sump AvailableYes

Diameter (mm)266

Invert Level (m)57.514

Minimum Outlet Pipe Diameter (mm)300

Suggested Manhole Diameter (mm)2100

Control Points

Head (m)

Flow (l/s)

Design Point (Calculated)

1.800

43.0

Flush-Flo™

0.552

42.8

Control Points

Head (m)

Flow (l/s)

Kick-Flo®

1.205

35.4

Mean Flow over Head Range

-

36.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)

Flow (l/s)

0.100

8.5

0.200

27.3

0.300

40.2

0.400

42.0

0.500

42.7

0.600

42.7

0.800

41.9

1.000

40.2

Depth (m)

Flow (l/s)

1.200

35.7

1.400

38.1

1.600

40.6

1.800

43.0

2.000

45.2

2.200

47.3

2.400

49.3

2.600

51.3

Depth (m)

Flow (l/s)

3.000

55.0

3.500

59.2

4.000

63.2

4.500

66.9

5.000

70.4

5.500

73.7

6.000

76.9

6.500

80.0

Depth (m)

Flow (l/s)

7.000

82.9

7.500

85.7

8.000

88.5

8.500

91.1

9.000

93.7

9.500

96.2

Hydro-Brake® Optimum Manhole: S775, DS/PN: S12.008, Volume (m³): 53.7

Unit Reference MD-SHE-0177-1850-2000-1850

Design Head (m)2.000

Design Flow (l/s)18.5

Flush-Flo™Calculated

ObjectiveMinimise upstream storage

ApplicationSurface

Sump AvailableYes

Diameter (mm)177

Invert Level (m)70.188

Minimum Outlet Pipe Diameter (mm)225

Suggested Manhole Diameter (mm)1800

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Hydro-Brake® Optimum Manhole: S775, DS/PN: S12.008, Volume (m³): 53.7					
Control Points		Head (m)	Flow (l/s)	Control Points	
Head (m)		Flow (l/s)		Head (m)	
Flow (l/s)		Flow (l/s)		Flow (l/s)	
Design Point (Calculated)		2.000	18.5	Kick-Flo® 1.231 14.7	
Flush-Flo™		0.584	18.5	Mean Flow over Head Range - 16.1	
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated					
Depth (m)		Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)
Flow (l/s)		Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)
Flow (l/s)		Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)
0.100 6.3		1.200 15.2	3.000 22.4	7.000 33.7	
0.200 15.4		1.400 15.6	3.500 24.2	7.500 34.9	
0.300 17.1		1.600 16.6	4.000 25.8	8.000 36.0	
0.400 18.0		1.800 17.6	4.500 27.3	8.500 37.0	
0.500 18.4		2.000 18.5	5.000 28.7	9.000 38.1	
0.600 18.5		2.200 19.3	5.500 30.0	9.500 39.1	
0.800 18.1		2.400 20.2	6.000 31.3		
1.000 17.3		2.600 21.0	6.500 32.5		
Hydro-Brake® Optimum Manhole: S816, DS/PN: S1.015, Volume (m³): 212.9					
Unit Reference		MD-SHE-0359-8300-1500-8300			
Design Head (m)		1.500			
Design Flow (l/s)		83.0			
Flush-Flo™		Calculated			
Objective		Minimise upstream storage			
Application		Surface			
Sump Available		Yes			
Diameter (mm)		359			
Invert Level (m)		56.344			
Minimum Outlet Pipe Diameter (mm)		375			
Suggested Manhole Diameter (mm)		Site Specific Design (Contact Hydro International)			
Control Points		Head (m)	Flow (l/s)	Control Points	
Head (m)		Flow (l/s)		Head (m)	
Flow (l/s)		Flow (l/s)		Flow (l/s)	
Design Point (Calculated)		1.500	83.0	Kick-Flo® 1.120 72.0	
Flush-Flo™		0.578	83.0	Mean Flow over Head Range - 68.6	
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated					
Depth (m)		Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)
Flow (l/s)		Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)
Flow (l/s)		Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)
0.100 10.3		0.600 82.9	1.600 85.6	2.600 108.4	
0.200 36.1		0.800 81.3	1.800 90.6	3.000 116.2	
0.300 67.2		1.000 77.4	2.000 95.4	3.500 125.2	
0.400 81.0		1.200 74.5	2.200 99.9	4.000 133.7	
0.500 82.6		1.400 80.2	2.400 104.2	4.500 141.6	
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<u>Hydro-Brake® Optimum Manhole: S816, DS/PN: S1.015, Volume (m³): 212.9</u>				
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m) Flow (l/s) Depth (m) Flow (l/s)
5.000	149.1	6.500	169.5	8.000 187.6 9.500 204.1
5.500	156.2	7.000	175.7	8.500 193.3
6.000	163.0	7.500	181.8	9.000 198.8

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Storage Structures for HIF - 7 Tank or Pond Manhole: S763, DS/PN: S1.012 Invert Level (m) 57.514 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>3200.0</td><td>2.000</td><td>5519.5</td><td>2.500</td><td>6197.5</td></tr></table> Tank or Pond Manhole: S775, DS/PN: S12.008 Invert Level (m) 69.858 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>1200.0</td><td>2.000</td><td>2742.2</td><td>2.330</td><td>3057.0</td></tr></table> Tank or Pond Manhole: S816, DS/PN: S1.015 Invert Level (m) 56.344 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>2100.0</td><td>1.356</td><td>3345.8</td><td>1.656</td><td>3660.5</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	3200.0	2.000	5519.5	2.500	6197.5	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	1200.0	2.000	2742.2	2.330	3057.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	2100.0	1.356	3345.8	1.656	3660.5
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																																	
0.000	3200.0	2.000	5519.5	2.500	6197.5																																	
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																																	
0.000	1200.0	2.000	2742.2	2.330	3057.0																																	
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																																	
0.000	2100.0	1.356	3345.8	1.656	3660.5																																	
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for HIF - 7

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.000	S700	-0.320	0.000	0.05		13.6	OK	
S1.001	S701	-0.279	0.000	0.15		40.0	OK	
S2.000	S702	-0.317	0.000	0.06		13.9	OK	
S2.001	S703	-0.295	0.000	0.10		27.8	OK	
S2.002	S704	-0.257	0.000	0.22		27.9	OK	
S1.002	S705	-0.294	0.000	0.26		97.9	OK	
S1.003	S706	-0.277	0.000	0.31		126.7	OK	
S1.004	S707	-0.269	0.000	0.34		130.9	OK	
S1.005	S708	-0.314	0.000	0.20		153.3	OK	
S3.000	S709	-0.293	0.000	0.10		17.5	OK	
S3.001	S710	-0.285	0.000	0.13		41.4	OK	
S3.002	S711	-0.283	0.000	0.14		41.0	OK	
S3.003	S712	-0.312	0.000	0.21		87.5	OK	
S3.004	S713	-0.302	0.000	0.23		93.6	OK	
S3.005	S714	-0.289	0.000	0.27		100.5	OK	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)	
S11.004	S761	-0.695	0.000	0.12		318.4	OK

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S17.002	S808	-0.347	0.000	0.23		52.6	OK	

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Designed by UKDSF001
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Network 2018.1.1

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S11.004	S761	-0.661	0.000	0.16		427.1	OK	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S17.002	S808	-0.316	0.000	0.31		70.6	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for HIF - 7

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S11.004	S761	-0.577	0.000	0.27		740.5	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for HIF - 7

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S17.002	S808	-0.229	0.000	0.56		125.4	OK	

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PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S11.004	S761	-0.444	0.000	0.50		1350.6	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for HIF - 7

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S17.002	S808	-0.011	0.000	0.95		214.4	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for HIF - 8

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	5
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for HIF - 8

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.859	4-8	2.781	8-12	0.523

Total Area Contributing (ha) = 4.164

Total Pipe Volume (m³) = 260.472

Network Design Table for HIF - 8

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	125.176	0.392	319.2	0.458	5.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	6.84	59.775	0.458	0.0	0.0	0.0	1.13	180.1	62.0

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Synthetic Rainfall Details FEH Rainfall Version 2013 Site Location GB 489026 242081 SP 89026 42081 Data Type Point Summer Storms Yes Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30		
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Online Controls for HIF - 8 Hydro-Brake® Optimum Manhole: S819, DS/PN: S1.006, Volume (m³): 63.4 Unit Reference MD-SHE-0176-1600-1300-1600 Design Head (m)1.300 Design Flow (l/s)16.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)176 Invert Level (m)57.207 Minimum Outlet Pipe Diameter (mm)225 Suggested Manhole Diameter (mm)1500 <table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.300</td><td>16.0</td><td>Kick-Flo®</td><td>0.860</td><td>13.2</td></tr><tr><td>Flush-Flo™</td><td>0.393</td><td>15.9</td><td>Mean Flow over Head Range</td><td>-</td><td>13.8</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>6.2</td><td>1.200</td><td>15.4</td><td>3.000</td><td>23.8</td><td>7.000</td><td>35.8</td></tr><tr><td>0.200</td><td>14.8</td><td>1.400</td><td>16.6</td><td>3.500</td><td>25.6</td><td>7.500</td><td>37.0</td></tr><tr><td>0.300</td><td>15.7</td><td>1.600</td><td>17.6</td><td>4.000</td><td>27.3</td><td>8.000</td><td>38.2</td></tr><tr><td>0.400</td><td>15.9</td><td>1.800</td><td>18.7</td><td>4.500</td><td>28.9</td><td>8.500</td><td>39.3</td></tr><tr><td>0.500</td><td>15.8</td><td>2.000</td><td>19.6</td><td>5.000</td><td>30.4</td><td>9.000</td><td>40.4</td></tr><tr><td>0.600</td><td>15.5</td><td>2.200</td><td>20.5</td><td>5.500</td><td>31.9</td><td>9.500</td><td>41.5</td></tr><tr><td>0.800</td><td>14.1</td><td>2.400</td><td>21.4</td><td>6.000</td><td>33.2</td><td></td><td></td></tr><tr><td>1.000</td><td>14.1</td><td>2.600</td><td>22.2</td><td>6.500</td><td>34.6</td><td></td><td></td></tr></table> <tr><td colspan="3">©1982-2018 Innovyze</td></tr>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.300	16.0	Kick-Flo®	0.860	13.2	Flush-Flo™	0.393	15.9	Mean Flow over Head Range	-	13.8	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.2	1.200	15.4	3.000	23.8	7.000	35.8	0.200	14.8	1.400	16.6	3.500	25.6	7.500	37.0	0.300	15.7	1.600	17.6	4.000	27.3	8.000	38.2	0.400	15.9	1.800	18.7	4.500	28.9	8.500	39.3	0.500	15.8	2.000	19.6	5.000	30.4	9.000	40.4	0.600	15.5	2.200	20.5	5.500	31.9	9.500	41.5	0.800	14.1	2.400	21.4	6.000	33.2			1.000	14.1	2.600	22.2	6.500	34.6			©1982-2018 Innovyze		
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																																										
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for HIF - 8

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (1/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (1/s)		
S1.000	S800	-0.239	0.000	0.39		67.6	OK	
S1.001	S801	-0.293	0.000	0.39		97.0	OK	
S1.002	S802	-0.263	0.000	0.42		92.6	OK	
S2.000	S803	-0.259	0.000	0.33		56.3	OK	
S2.001	S804	-0.225	0.000	0.50		84.7	OK	
S1.003	S805	-0.246	0.000	0.64		172.5	OK	
S1.004	S806	-0.381	0.000	0.29		193.1	OK	
S3.000	S807	-0.197	0.000	0.44		47.4	OK	
S3.001	S808	-0.290	0.000	0.27		75.8	OK	
S3.002	S809	-0.181	0.000	0.58		87.6	OK	
S1.005	S810	-0.445	0.000	0.25		261.7	OK	
S4.000	S811	-0.359	0.000	0.21		57.5	OK	
S4.001	S812	-0.393	0.000	0.35		149.1	OK	
S4.002	S813	-0.399	0.000	0.35		164.4	OK	
S5.000	S814	-0.226	0.000	0.29		40.1	OK	



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